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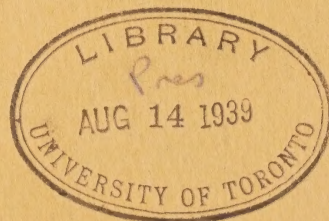
HOUSEHOLD INSECTS AND THEIR CONTROL BY ARTHUR GIBSON & C.R. TWINN



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DEPARTMENT OF AGRICULTURE

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DOMINION OF CANADA—DEPARTMENT OF AGRICULTURE

HOUSEHOLD INSECTS AND THEIR CONTROL


by

ARTHUR GIBSON and C. R. TWINN

DIVISION OF ENTOMOLOGY
SCIENCE SERVICE

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The house fly, enlarged and natural size (authors' illustration).

HOUSEHOLD INSECTS AND THEIR CONTROL

(WITH A CHAPTER ON ANIMAL PESTS OTHER THAN INSECTS)

By ARTHUR GIBSON and C. R. TWINN

INTRODUCTION

Many kinds of insects occur in dwellings. Some of them attack humans and may be associated with the dissemination of disease. Others feed upon clothing, house furnishings, and other articles of value, and often do serious damage. Still others infest foodstuffs and not only cause material loss or render them unfit for human consumption, but by contaminating them with bacteria and other organisms may endanger health. Certain species are pests of house plants, and so on, apparently little in the home being exempt from attack. It is the purpose of this bulletin to give useful information regarding insects and certain other pests of dwellings, the conditions under which they thrive, and the best available recommendations for their control.

GENERAL RECOMMENDATIONS

Care and cleanliness in housekeeping is of prime importance in reducing or preventing insect development. Woollens, furs, and other articles of animal origin subject to attack by clothes moths and carpet beetles should not be left lying about unprotected, particularly in summer time. Carpets and rugs should be either raised and beaten at intervals or periodically cleaned with a vacuum cleaner. Cracks between floor boards, and crevices behind baseboards and in cupboards which harbour lint and dirt, and serve as a refuge for insects should be eliminated as far as possible, or cleaned out periodically. The air shafts of hot-air furnaces should be kept clean. Basements, too, need periodical attention. Foodstuffs should be carefully protected from the attentions of flies and the attacks of such insects as cockroaches, ants, and the various species that infest cereals, meats and fruits. Food debris should not be left lying on floors, tables, pantry shelves or elsewhere. Clean personal habits will eliminate human body parasites such as lice, and regular washing and proper care of domestic pets such as dogs and cats will destroy fleas. The use of adequate screens on doors and windows excludes many pests. Precautions should be taken to prevent the introduction of insects into the home in foodstuffs and on clothing, in furniture and other household furnishings, particularly second-hand goods.

Such widespread and troublesome insects as mosquitoes and houseflies may be largely reduced in numbers by dealing intelligently with their breeding places. To combat these pests effectively, organized community effort is often desirable and necessary, but much may be done by individuals in alleviating local conditions. In any event the active co-operation of householders is necessary to produce entirely satisfactory results.

Where household pests have become established there are a number of ways in which they may be eliminated. These include the use of fumigants and other insecticides, the application of heat and cold, improved housekeeping methods and the treatment or elimination of breeding places.

The drawings for the illustrations used in this bulletin were made by Frank C. Hennessey, Artist, Division of Entomology.

FUMIGANTS AND OTHER INSECTICIDES RECOMMENDED FOR THE CONTROL OF HOUSEHOLD INSECTS AND OTHER PESTS

In the pages of this bulletin there are numerous references to certain fumigants and other insecticides recommended for the control of various insects and other undesirable pests found infesting dwellings. Among these are hydrocyanic acid gas, ethylene dichloride-carbon tetrachloride, carbon bisulphide, carbon tetrachloride, sulphur, naphthalene, paradichlorobenzene, sodium fluoride, borax, pyrethrum and nicotine. The nature of these materials, their application, and the conditions under which they should be used are described in detail in the following pages.

HYDROCYANIC ACID GAS

This gas is one of the most effective fumigants used in the control of insects and it may be employed without injury to furniture, fabrics or other household goods and equipment. *Hydrocyanic acid gas is, however, extremely poisonous to animals and humans and should be used only by intelligent and careful persons fully cognizant of its dangerous properties, and equipped with efficient gas masks.* In Ontario, the fumigation of dwellings with hydrocyanic acid or cyanide compounds may be undertaken only by licenced operators in possession of a permit issued by the Provincial Department of Health, and in accordance with strict regulations drawn up by that department. Similar restrictions are in force in the city of Montreal. Other regions and other municipalities may take action along these lines. It is therefore incumbent on all persons who wish to use hydrocyanic acid, or cyanide compounds for fumigation, to ascertain from the authorities concerned, whether or not regulations are in force governing the use of such gases, and, if so, to comply with them. In order to guard against accidents, the work of fumigating buildings should be conducted by at least two persons, warning notices should be posted throughout the fumigation process, and a watchman should be stationed outside the building to prevent persons from entering. The materials used in fumigation should not be left where they are accessible to irresponsible persons or children.

Fumigation with hydrocyanic acid gas should be attempted only in buildings that have been completely vacated. It would be highly dangerous to fumigate partially occupied semi-detached houses or single rooms or apartments in occupied buildings. The temperature of the structure to be fumigated should be maintained at 70° F. or over, and not less than 65° F. Insects become dormant at low temperatures and are less liable to be killed by the gas. Best results are secured on a calm day as the gas is apt to be dissipated in windy weather.

Preparing to Fumigate.—Measure the cubical contents of the space to be fumigated including rooms, hallways, basements and attics, in order to make an estimate of the quantity of materials required. Close all openings such as windows, chimney places, ventilators and outside doors, and stop up any cracks through which the gas may escape, with wet paper or gummed paper strips. Open cupboards, drawers and trunks and raise the carpets from the floor in order to allow the gas to penetrate freely to all places where insects may be in hiding. Remove moist and liquid foodstuffs. Make arrangements to open one or two doors or windows from the outside, if possible on each floor, so that the building may be thoroughly aired before it is entered after the fumigation is complete. Before commencing the fumigation make sure that the building is completely vacant and arrange for the ready egress of the operators. As the gas is lighter than air, commence at the top floor of the building and work down. When all is complete, close and lock the outer doors, post warning notices and station a watchman to prevent persons from entering the building.

There are several methods of generating hydrocyanic acid gas. Two widely used methods are described in this bulletin. One is the liquid or pot method in which the gas is evolved from the action of sulphuric acid on sodium cyanide. The other, which is easier to apply and less dangerous than the pot method, consists of exposing calcium cyanide to the action of atmospheric moisture.

The Calcium Cyanide Method.—Calcium cyanide is sold in tightly sealed cans in the form of dust or fine granules. Coarse grade dust is recommended for the fumigation of buildings. It is applied merely by spreading it thinly on dry papers. It combines with the moisture in the air evolving hydrocyanic acid gas and leaves a residue of calcium hydroxide. In applying it the instructions and precautions given in the preceding paragraphs must be carefully followed. In order to increase the humidity of the air and thus accelerate the liberation of the gas, a little water should be sprinkled lightly about the building an hour or two before fumigating. No surplus water should be on the floors when the calcium cyanide is distributed. The amount of material to use depends on several factors such as the hydrocyanic acid content of the product (as given on the container), the construction of the building to be fumigated, the temperature, the period of exposure, and the insect species involved. For general purposes a dosage equivalent to 8-16 ounces of hydrocyanic acid (HCN) to each 1,000 cubic feet of space has been found satisfactory. When all is in readiness distribute dry newspapers about the floors of the rooms and hallways and place in each doorway the requisite number of cans of calcium cyanide with the lids loosened. Commencing at the top of the building scatter the calcium cyanide in a thin layer on the newspapers. Leave the ground floor and basement until the last and treat them simultaneously, the two operators meeting at the exit and leaving the building together. Lock the doors, post warning notices, and station a watchman.

The building should remain closed preferably for 24 hours. After being thoroughly aired for at least four hours by opening doors and windows from the outside, it may be entered and occupied. *It is a necessary precaution to beat and air pillows and other bedding thoroughly, and to sleep with the windows open following the fumigation.* The residue from the calcium cyanide should be rolled up in the papers and disposed of by burying.

The Pot Method of Fumigation.—The materials necessary for this method are sodium cyanide, 96-99 per cent pure; commercial sulphuric acid, 66° Baumé; water; and several large earthenware crocks each of from two to four gallons capacity. Sodium cyanide is a deadly poison and sulphuric acid highly corrosive, and great precautions are necessary in handling them. Goggles and rubber gloves should be worn to guard against burns to eyes and hands. It is also advisable to wear old clothing when fumigating with these materials, and to have on hand a strong solution of common washing soda with which to neutralize any of the acid that may be splashed inadvertently on one's person. Gloves should be worn when handling any cyanide compounds.

The pot method of fumigation consists of dropping sodium cyanide into diluted sulphuric acid, hydrocyanic acid gas being rapidly evolved leaving a residue of sodium sulphate. The amounts of materials to use for each 1,000 cubic feet of space are:—

Sodium cyanide.....	16 ounces by weight
Sulphuric acid.....	24 fluid ounces
Water.....	32 fluid ounces

This dosage may be increased or decreased as circumstances dictate, depending on the temperature and other factors involved.

Place the crocks in a sink or bath tub. Pour in each the necessary quantity of water, afterwards carefully adding the acid, allowing it to run slowly down the

side of the crock, stirring meanwhile. *Never add the water to the acid.* The addition of the acid causes the evolution of considerable heat and if done hurriedly may cause boiling and splashing. Distribute the crocks in each of the rooms to be fumigated placing them on thick layers of newspapers to protect the floors from any acid which may be spilled or splashed over. Weigh out the requisite amount of sodium cyanide for each crock into thin paper bags. Place a bag beside each crock. When the directions and precautions described in earlier paragraphs have been observed and all is in readiness, commence at the top floor and drop the bags into the crocks. Do each floor in succession, working from the top down. Then close up all entrances to the building, post warning notices and station a watchman. Allow the fumigation to proceed preferably for 24 hours. Afterwards the building should be well aired as indicated under the calcium cyanide method, and the residue from the acid and sodium cyanide disposed of down a drain or sink, or buried in the ground.

Cyanogen Chloride Mixture.—This fumigant has come into prominence for use in dwellings on account of its warning properties. It is produced by dropping a mixture of sodium cyanide and sodium chlorate in dilute hydrochloric acid. The resultant gas is a mixture of two gases, namely, hydrocyanic acid (HCN) and cyanogen chloride (CNCL). Cyanogen chloride is a highly irritant gas and has an intense lachrymatory (tear gas) effect even in non-lethal concentrations. This feature may be of value in preventing accidents or fatalities in fumigation work. Cyanogen chloride is reported to be almost as toxic as hydrocyanic acid, and not only a good insecticide, but also a germicide. In using it, the precautions given in preceding paragraphs must be observed.

Warning.—Persons overcome by hydrocyanic acid gas should be removed into the fresh air, but should be protected from chill. Call a doctor immediately, loosen the clothing, and wrap the patient in warm blankets. If the breathing has stopped, practice artificial respiration. The patient should be kept as quiet as possible, and neither alcohol nor emetics should be given.

ETHYLENE OXIDE-CARBON DIOXIDE

This fumigant consists of one part ethylene oxide to nine parts of carbon dioxide. It is sold in pressure cylinders of 25 pounds and 50 pounds capacity. Under these conditions it is in liquid form. This fumigant was first investigated and developed by research workers in the United States Department of Agriculture. It is relatively non-toxic to humans, non-inflammable, and may be used without injurious effects in the control of household and stored product insects infesting various materials. The gas is released from the cylinders into fumigation vaults or other structures to be fumigated, through flexible metal tubing, preferably copper. When released slowly to the atmosphere the mixture immediately vaporizes. When quantities smaller than the contents of the cylinder are required, the cylinder may be placed on a scale and the dosage accurately weighed. During recent years we have had a number of opportunities of testing this gas, as a result of which we were impressed with its remarkable penetrating qualities and its effectiveness in destroying insect life. Undoubtedly it is one of the most efficient fumigants so far known, and but for its high cost would probably largely replace hydrocyanic acid gas in general fumigation work. Despite its cost, however, this gas may be used economically in fumigating material generally treated in fumigation vaults. Our experience with it has amply demonstrated that ethylene oxide-carbon dioxide has penetrating qualities superior to hydrocyanic acid gas, although the latter is known to be an extremely penetrating gas. As with other gases, the dosage required depends on several factors. In reasonably gas-tight chambers, at temperatures over 65° F., dosages of 10-20 lb. per 1,000 cubic feet during overnight periods have been found effective.

ETHYLENE DICHLORIDE-CARBON TETRACHLORIDE

The valuable properties of ethylene dichloride-carbon tetrachloride as a safe and effective fumigant have been well demonstrated. This fumigant consists of three parts by volume of ethylene dichloride and one part by volume of carbon tetrachloride, and is obtainable already prepared for use. It gives off a gas heavier than air which is destructive to insect life, but comparatively harmless to humans. This gas has the further advantage of being non-inflammable and non-injurious to fabrics, furniture and other household goods. Its discoverers, Messrs. R. T. Cotton and R. C. Roark, United States Department of Agriculture, recommend that it be used in gas-tight chambers at the rate of 5 quarts or 14 lb. of liquid to each 1,000 cubic feet of space, at a temperature of not less than 65° F. (preferably 70° F. or over) for a period of 24 hours. It has been found very satisfactory in destroying insects infesting upholstered furniture, clothing, various stored products, etc. It is an excellent substitute for carbon bisulphide (the gas from which is highly inflammable and explosive) and may be used in fumigating gas-tight rooms, trunks, closets, etc., under household conditions. This fumigant may be applied by pouring it into shallow pans and placing the latter at the top of the enclosed space to be fumigated, or by soaking sacks, blankets or other similar materials in it, and suspending these to accelerate the vaporization of the gas. The gas penetrates downward through the infested materials. Persons using the gas should avoid breathing it in large quantities as it has an anaesthetic action somewhat similar to that of chloroform.

CARBON BISULPHIDE

Carbon bisulphide is a colourless liquid which on exposure to air vaporizes into a foul-smelling, highly inflammable, poisonous gas, heavier than air. Used in sufficient concentration and at the right temperature it is very destructive to insect life and has excellent penetrating qualities. It is extremely useful for carrying out fumigation work on a small scale such as fumigating insect-infested materials in tightly constructed boxes, trunks and other containers. It is also useful in destroying insects that nest underground such as certain species of wasps and ants. Owing to the highly inflammable nature of carbon bisulphide gas and the fact that it forms an explosive mixture with air, it should not be used in the fumigation of buildings. There is little danger, however, when it is applied as suggested, providing reasonable care is exercised and it is not exposed to any form of fire.

Carbon bisulphide is most effective when used at temperatures of 70° F., or over. The quantity to use varies from 5 to 10 lb. or more of liquid to each 1,000 cubic feet of space, depending on the gas-tightness of the receptacle to be fumigated. Receptacles used in fumigation may be made more gas-tight by pasting paper strips over all cracks and other openings. Carbon bisulphide gas is nearly three times heavier than air and penetrates downwards. It is necessary, therefore, to expose the liquid carbon bisulphide at the top of the space to be fumigated, using shallow containers for this purpose. The fumigation should be allowed to continue for at least 24 hours.

CARBON TETRACHLORIDE

Carbon tetrachloride is often used in place of carbon bisulphide as a fumigant chiefly owing to the fact that the gas into which it vaporizes is non-inflammable. Apart from the absence of fire hazard, however, it has the disadvantage of being considerably less effective than carbon bisulphide and it is necessary to use twice or three times the quantity required when using the latter. Carbon tetrachloride may be used for fumigation purposes under conditions similar to those described for carbon bisulphide. The gas into which it vaporizes is heavier than air. To secure good results it is necessary to use from 15 to 20 lb. of liquid to each 1,000 cubic feet of space in reasonably gas-tight rooms or receptacles, at a temperature of not less than 70° F., for a period of at least 24 hours.

SULPHUR

When sulphur is burned it combines with oxygen in the air forming sulphur dioxide. Sulphur fumigation has been widely used owing to the cheapness and availability of this material. Our experience, however, indicates that it is decidedly less effective in destroying insects than hydrocyanic acid gas. Moreover, it tarnishes metals and has a bleaching effect on wallpaper and fabrics, particularly in the presence of moisture. For this reason its use is not specially recommended in this bulletin.

The following directions are given, however, for those who wish to make use of it. Remove metal objects or smear them with a thin coating of vaseline. Make the rooms as gas-tight as possible, as described under hydrocyanic acid gas fumigation. Open all cupboards, drawers, etc. Secure a sufficient number of old pails or other metal containers and place one in each room. Stand each pail in a larger vessel containing a little water to prevent danger of fire. Place a small heap of charcoal in the bottom of each pail, ignite it and when it is burning well, carefully add the sulphur. Close the door of each room and make it as gas-tight as possible with newspapers or gummed paper strips. Allow the fumigation to proceed for from 18 to 24 hours. At least 2 lb. of sulphur should be burned for each 1,000 cubic feet of space. If the space to be fumigated is not gas-tight the amount of sulphur should be increased.

NAPHTHALENE

Naphthalene is a popular, well-tried and safe material, for use in preventing injury to clothing and other fabrics by clothes moths, carpet beetles, and other insects. It is sold in the form of flakes and moth balls by most druggists, the flakes often being mixed with lavender flowers or red cedar chips. In our opinion best results are secured by using naphthalene alone.

The fumes of naphthalene, when present in a sufficiently high concentration, are lethal to insects. As the fumes are given off very slowly, naphthalene finds its best application in protecting materials in tightly constructed chests, trunks, and other receptacles over extended periods of time. To be effective it is necessary to use about 1 lb. of fresh naphthalene to an ordinary sized trunk and to renew the material at least once each year, preferably early in the spring.

PARADICHLOROBENZENE

Paradichlorobenzene is a white crystalline powder which, at ordinary temperatures, slowly vaporizes into a gas. The gas is non-inflammable and non-poisonous to humans, but is toxic to insects. It is effective in preventing insect injury when used in reasonably gas-tight receptacles in the same quantities as naphthalene. It has proved as satisfactory as the latter when used under similar conditions, but is usually sold at a considerably higher price.

SODIUM FLUORIDE

Sodium fluoride is sold in the form of a fine white powder. It is an effective insecticide against such insects as cockroaches, silverfish and ants, and forms the basis of many proprietary insect powders. It is applied by scattering or dusting it in places frequented by these insects. The small puffers or insect guns sold by druggists are useful for distributing the powder. Small particles of the powder adhere to the bodies of the insects and, in endeavouring to clean themselves with their mouthparts, they are poisoned by it. Sodium fluoride does not lose its effectiveness on exposure to air as does pyrethrum, and may be left in infested places until the insects have all disappeared, or as long as convenient.

In view of its poisonous nature, care should be taken in using sodium fluoride, and children or domestic animals should not be allowed to have access to it.

BORAX

In the past powdered borax has been used as a cockroach poison, either alone or mixed with powdered sweet chocolate or sugar. In recent years, however, it has been superseded to a considerable extent by sodium fluoride. Unlike the latter it is not an active poison to man or domestic animals. In addition to its use against cockroaches, borax is also of value as a larvicide to destroy house fly maggots in manure.

PYRETHRUM

Pyrethrum, also known as Persian insect powder, Dalmatian powder, and buhach, is a yellowish powder made from the finely ground flower heads of certain species of chrysanthemums. It has excellent insecticidal properties when fresh and of good quality, and forms the basis of numerous proprietary insect powders and fly sprays. Its value as an insecticide is due to the presence of a volatile oil (pyrethrins) which on contact with insects kills or paralyses them. Pyrethrum deteriorates when held in storage. It slowly loses its insecticidal activity even in closed containers, but this loss is greatly accelerated in the presence of air and light. It is therefore necessary to use only good quality material and to store it in tightly sealed containers, preferably in a cool place. Pyrethrum is harmless to humans and animals and particularly well adapted for use under household conditions. When used in powder form it may be distributed by means of a small puffer or hand-duster.

PYRETHRUM-KEROSENE SPRAY

A very useful spray for destroying insects in dwellings may be easily and cheaply made from pyrethrum insect powder and kerosene. This may be prepared by adding from one-half to one pound of pyrethrum to one gallon of kerosene, allowing the mixture to stand and agitating it at intervals over a period of about two hours (or longer), thus ensuring that the active principles of the pyrethrum are extracted. The residue of the pyrethrum settles to the bottom of the vessel as a brown sediment, and the clear liquid, which is pale lemon-yellow in colour, may either be siphoned or filtered off. When the spray is required for use in farm buildings, it may be satisfactorily prepared with ordinary kerosene and it is unnecessary to add any other chemicals. For household use, however, to remove any possibility of staining fabrics or furniture, it is preferable to use water-white kerosene. In order to impart a pleasant odour, methyl salicylate, oil of sassafras, or some other essential oil may be added at the rate of three fluid ounces or less to each gallon. The addition of such oils is not essential, particularly if odourless kerosene is used. The spray should be kept in a tightly corked container and protected from sunlight, to prevent it from deteriorating in strength.

To destroy flies the spray should be applied in the form of a fine mist by means of a small hand sprayer or other form of atomizer. The spray operates best in a confined space and most satisfactory results are secured when doors and windows are closed. The dead and paralysed insects should be swept up and burned or dropped into hot water to prevent any of the latter from recovering.

There are a number of proprietary fly sprays on the market similar in composition* to the one described, which may be substituted for it, by those who wish to avoid the trouble of preparing their own spray material. When obtainable, standardized kerosene extracts of pyrethrum may be substituted for the powder. In such case, it is only necessary to add the extract to the kerosene in proportions recommended by the manufacturer.

* The better ones contain extract equivalent to one pound of good quality pyrethrum powder per gallon.

DERRIS

Derris is an insecticide which consists of the powdered roots of tropical plants of the genera *Derris* and *Lonchocarpus*. The most important insecticidal constituent of this material is rotenone which acts on insects both as a contact and a stomach poison. Although highly toxic to insects it is relatively non-toxic to humans and wild and domestic animals. The use of derris and derris extracts in insecticidal sprays and dusts, including those for household purposes, is becoming increasingly widespread.

NICOTINE DUST

Dusts containing 2 per cent of nicotine have proven efficient in destroying insects such as aphids or plant lice and greenhouse whiteflies infesting house plants. The dusts may be applied by means of a small hand-duster or blower, after covering the plants with a cloth to prevent the material from being scattered about the room. Weigel and Middleton* recommend two formulae from which the dust may be prepared, either of which is effective. These are:—

Nicotine sulphate (40%).....	$\frac{1}{2}$ ounce
Hydrated lime.....	9 $\frac{1}{2}$ ounces

or

Nicotine sulphate (40%).....	$\frac{1}{2}$ ounce
Hydrated lime.....	4 $\frac{1}{2}$ ounces
Finely ground sulphur.....	5 ounces

“The nicotine-sulphate solution must be thoroughly mixed with the dust carrier, and the dust should either be used promptly or stored in an air-tight glass or metal container, to avoid loss of nicotine by evaporation. To prepare small quantities of this dust, first mix the dry ingredients carefully, then slowly sprinkle the required quantity of nicotine-sulphate solution over the dust, and mix thoroughly. Then sift the dust through a flour sieve about three times in order to obtain an even distribution of nicotine through the dust. The small lumps that may appear on the sieve screen, especially in the first sifting, should be crushed through the screen.” In preparing and applying the dust one should avoid inhaling it owing to its irritating effect on the delicate membranes of the nose and throat.

INSECT CONTROL BY TEMPERATURE

The application of high and low temperatures for the destruction of insect life is well-known and is useful against insects infesting dwellings and other buildings. If applied under the conditions and according to the directions given below it will be found a simple, inexpensive and effective method of control.

Superheating.—Superheating consists of raising the temperature of an infested room or building sufficiently high to cause the death of insects. It is most satisfactorily applied in the warm months of the year when outdoor temperatures are high, and preferably in calm weather. To be effective the temperature of the room or building must be raised to at least 120° F., preferably 130°, and maintained at that level for a period of six hours. In Canada, where the cold winters necessitate the use of central heating systems, this may be done in warm weather, often without recourse to additional means of heating. Where the permanent heating system is found inadequate for this purpose, available auxiliary means of raising the temperature must be introduced.

Before commencing to superheat, remove all inflammable materials, and articles and substances liable to be adversely affected by heat. Open cupboards, trunks and other receptacles, raise carpets, rugs, and the cushions of furniture, and spread out bedding and clothing to allow the heat to penetrate readily wherever insects may be hiding. Close windows tightly and, where

* U.S.F.B. 1495, 1926, p. 3.

possible, attach storm windows. Place a thermometer in each room about two feet from the floor level to record the temperature. When all is in readiness commence superheating. This preferably should be early in the morning in order that the operation may be completed and the dwelling occupied before nightfall. The time taken in reaching a temperature of 120° F., varies according to outside temperature conditions, the nature of the building and the efficiency of the heating system. Temperature readings should be made once each hour. After the temperature has reached 120° F. it should be maintained for a period of at least six hours. In order to lessen the possibility of injury to the finish of furniture it is advisable not to allow the temperature to rise above 140° F. at a point two feet from the floor level.

Freezing.—When outside temperatures register below zero, as often happens during the winter months in Canada, it is possible to destroy insects infesting upholstered furniture, fabrics, foodstuffs, etc., merely by exposing the infested articles outdoors for several hours. This simple but effective method is particularly valuable in ridding expensive upholstered furniture of such injurious insects as clothes moths. Its use may be extended to controlling insects in entire buildings, providing all water pipes, tanks, etc., are first emptied of water, and other precautions taken to prevent possible damage from the effects of freezing. Windows and doors must be opened and the sub-zero temperature allowed to penetrate throughout the building for a period of at least 12 hours and preferably for 24 hours.

INSECTS AFFECTING OUR PERSONS, HEALTH AND FOODSTUFFS

Under the above heading are included the two-winged flies, which are among the most annoying and dangerous of insects; body parasites such as bed-bugs, fleas and lice; and many diverse forms of insect life that chiefly affect foodstuffs, but certain of which may also have a deleterious effect on health.

1. Two-winged Flies

THE HOUSE FLY, *Musca domestica* L.

Of the several species of two-winged flies found in houses and other buildings, the house fly (frontispiece) is by far the most abundant and annoying. This species measures about one-quarter of an inch in length, is dusky-grey in colour and may be distinguished from other house-infesting flies by the presence of four dark longitudinal stripes on the thorax, and by its mouthparts which are pad-shaped at the tip and not fitted for piercing as are those of the stable fly which it closely resembles. The house fly is world-wide in distribution and is notorious for the part it plays in the dissemination of such dangerous diseases as typhoid, infantile diarrhoea, tuberculosis, cholera, dysentery, etc. It breeds in filth, such as various kinds of manure, human faeces and garbage. It is a menace to public health owing to its habit of passing directly from filth to human food carrying bacteria and other organisms and particles of decomposing organic matter on its hairy body and legs and sticky feet and mouth parts. Undesirable organisms may also be conveyed to food in its excreta and regurgitated saliva (fly-specks).

House flies pass through four life-stages; namely, the egg, larva or maggot, pupa (see fig. 1), and winged adult. The female flies deposit their small, elongate, pearly-white eggs in batches of 100 to 150 in fresh manure, human faeces, garbage, or other decomposing organic matter. It is possible for one female to lay 600 eggs or more during the course of her lifetime. The eggs hatch usually within 24 hours, the actual time varying with temperature conditions. The larvae are small, slender, creamy-white, headless and legless maggots. These may be seen readily as writhing masses close to the surface of the material

in which they are developing. On reaching maturity, which may happen in less than a week in warm weather, the larvae migrate to a suitable place to transform into the pupal stage. Pupation usually occurs along the edges of manure piles, in the surrounding soil, or in the ashes and soil with which city garbage dumps frequently are covered. The pupae are smooth, dark-brown in colour, and in size and shape as shown in figure 1. The pupal stage lasts about a week, more or less, depending on temperature conditions. From the pupae the winged flies emerge and shortly commence egg-laying. Thus, in warm weather the period elapsing from the time the egg is laid until the emergence of the winged fly may be less than two weeks.

Several generations of house flies develop during the warm months of the year, the number varying with the character of the season. The flies are most numerous in summer and early autumn, but diminish rapidly on the advent of cold weather.

Control.—The most effective and desirable method of controlling house flies consists of eliminating or reducing their breeding places to a minimum by properly treating or disposing of such materials as manure and garbage. Fresh horse manure is a prolific source of house fly production and this material is probably chiefly responsible for the majority of flies in rural sections. In the cities, where horses have been largely replaced in favour of mechanical transport, garbage is an important factor in fly production. To be effective, control measures directed against the breeding places should be organized on a community basis supported by a public well-informed on the menace of the house fly to health and the means by which it may be combated. One neglected manure heap or garbage dump is often sufficient to infest a whole neighbourhood, and it is therefore necessary to enlist the active co-operation of the whole community.

Treatment of Manure.—Stables, particularly those situated in urban sections, should be well constructed, the floors preferably being of concrete laid in such a manner as to allow of good drainage and thorough cleansing. Where it is not possible to remove the manure daily, it should be temporarily stored in fly-proof receptacles. Such receptacles may be constructed of concrete in the form of a large bin with a raisable lid to allow the manure to be thrown in, and a hinged door in the front which when lifted up allows the manure to be removed. In urban areas during the summer months collections of manure should be removed and disposed of at least twice a week. In rural sections, where practicable, the manure should be removed daily and spread thinly in fields where the drying effect of sun and wind will prevent breeding. An alternate method consists of taking advantage of the heat produced by fermentation when manure is placed in tightly packed piles. The manure pile should be constructed on hard ground or concrete to prevent the larvae from having access to soil in which to pupate. The sides of the pile should be clean cut and almost vertical, but sloping slightly towards the centre. As fresh manure is added to the pile it should be tightly packed by means of a shovel. The heat produced by fermentation is effective in destroying all house fly eggs, larvae and pupae, except possibly those close to the surface of the top layer. The application by means of a watering can of a solution of borax prepared by dissolving 1 lb. of borax in 6 gallons of water will effectively destroy any fly stages present in the top layer. Six gallons of the solution is sufficient to treat 30 square feet of surface area.

Another method to prevent flies breeding, recommended by United States authors, is to use a maggot trap consisting of a shallow concrete basin sloping slightly, and connected with a cistern by means of a drain fitted with a stopper. Over this basin is erected a wooden platform constructed of strips of wood nailed on a frame one foot high, the strips being about $1\frac{1}{2}$ inches apart. On this platform the manure is piled. Water is kept in the basin and the maggots migrating in search of soil to pupate fall into the water and are drowned. The water can

be drained into the cistern by removing the stopper at intervals. Manure should not be allowed to collect in the basin.

Steps also should be taken to prevent the accumulation of manures from other domestic livestock such as pigs, cattle and poultry, as flies will also breed in these substances, although to a much lesser extent.

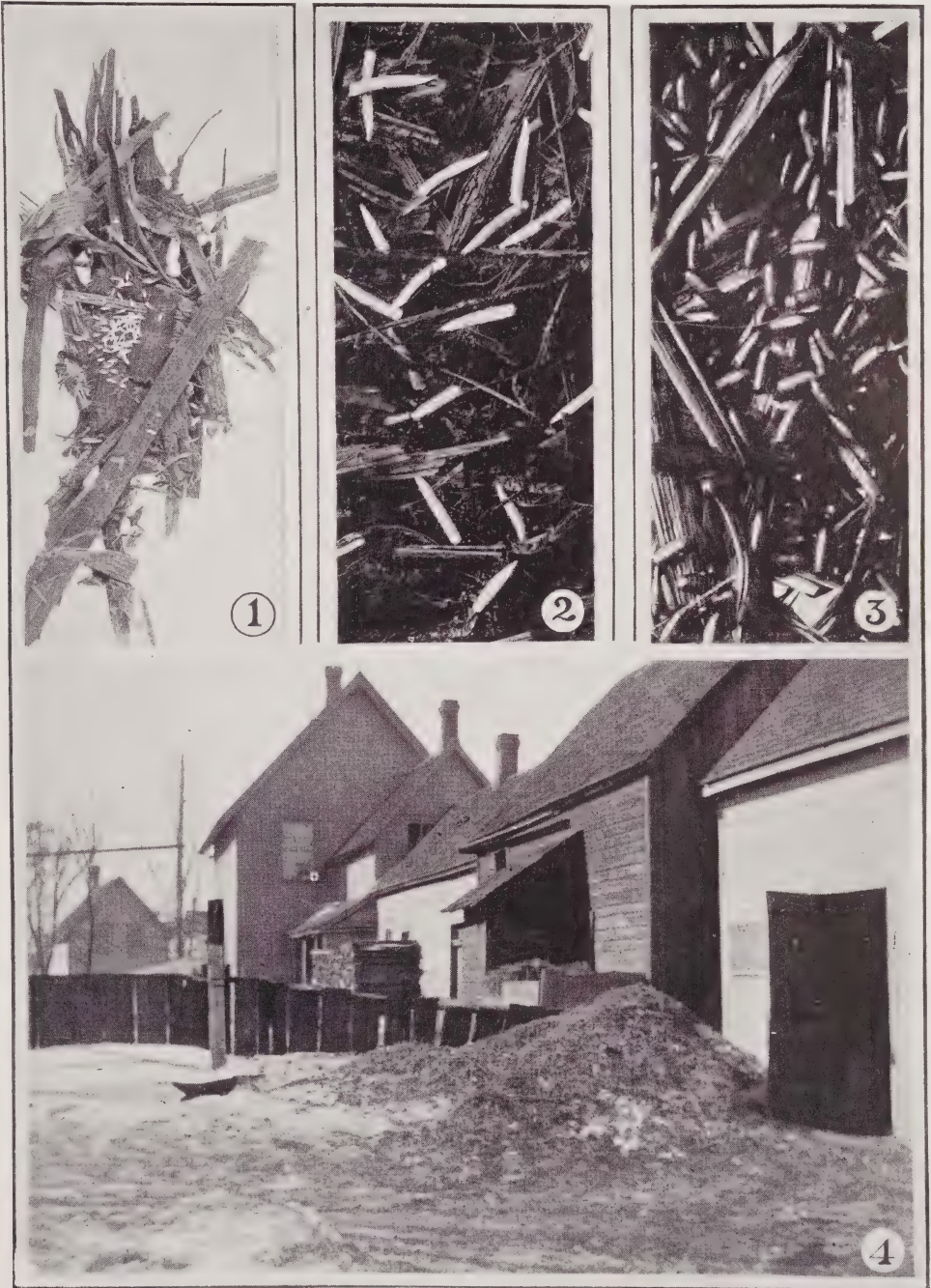


Fig. 1—The house fly; 1, eggs; 2, larvae; 3, pupae; all natural size; 4, manure pile—a typical breeding place (authors' illustration).

Treatment of Garbage.—Organic refuse such as household garbage should be wrapped in paper and stored in fly-proof garbage cans until finally disposed of by burning. The accumulating of garbage in municipal dumps during the warm months of the year should be discouraged. Such dumps produce enormous numbers of flies as well as other vermin, and with their malodorous exhalations constitute a serious public nuisance. The only satisfactory method of disposing of municipal garbage during the fly season consists in the use of incinerators. Covering the garbage with soil or ashes does not prevent flies from breeding, as in the majority of cases, the garbage becomes heavily infested with fly eggs and larvae before this work is carried out. Soil and ashes serve as a satisfactory medium for the larvae to pupate in and do not prevent the flies from emerging, as the latter have been known to force their way to the surface from pupae buried in six feet of sandy soil.

Treatment of Human Excrement.—The problem of fly-breeding in human excrement is largely confined to rural and suburban districts where open closets are commonly in use. Flies frequently swarm in great numbers about such places and constitute a very real menace to public health as they may readily carry disease organisms from the faecal matter to human food, particularly milk. Open closets should be adequately screened and the faeces liberally sprinkled with powdered borax or chloride of lime. Kerosene, also, has been found useful in this connection.

Control in Dwellings.—Although the removal and destruction of breeding places is the most effective method of disposing of the fly nuisance, it undoubtedly will be many years before it is generally adopted, and, in the meantime, measures should be taken to exclude flies from dwellings and to prevent them from contaminating food. Doors and windows of houses and other buildings should be screened and all flies that gain access destroyed. This may be done by the use of fly swatters, adhesive fly papers, or poisoned fly pads, or by exposing in saucers, out of reach of children or pets, poisoned bait made by mixing one teaspoonful of formalin in a cupful of sweetened milk or water, or by spraying with the pyrethrum-kerosene spray described on page 11. This fly spray, which is cheap and easy to prepare, operates best in a closed space. The dead and paralysed flies should be swept up and burned or thrown into very hot water to prevent any of the latter from recovering.

THE LESSER HOUSE FLY, *Fannia canicularis* L.

Next in importance to the common house fly, among flies infesting dwellings, is the lesser house fly. This species is most noticeable in spring and early summer before it is vastly outnumbered, on the advent of hot weather, by the common house fly, for which it is often mistaken. It is smaller than the common house fly, but may be distinguished from the latter by the presence of only three dark longitudinal stripes on the thorax, and by the narrow tapering abdomen, the basal segments of which are partially translucent. The larvae are flattened, spiny maggots and breed in decaying organic matter and human faeces.

Control.—The measures recommended in connection with the care and disposal of decaying organic matter, and the disposal and treatment of manure and human faeces to prevent the breeding of house flies and the spread of disease (see p. 14) are equally applicable in the case of the above species. The screening of doors and windows and the destruction of flies that gain entrance by the use of tanglefoot, poisoned bait or fly sprays (see above) are also recommended.

THE LATRINE FLY, *Fannia scalaris* Fab.

The latrine fly is closely related to the lesser house fly, which it greatly resembles. It has been named the latrine fly owing to its habit of breeding in human excrement. It is commonly found in dwellings.

THE LARGE STABLE FLY, *Muscina stabulans* Fall.

The large stable fly is often found in dwellings, and is commonly mistaken for the house fly. It closely resembles the latter species, but is larger and more robust. The larvae breed in various kinds of decomposing organic matter.

Control.—Dispose of decomposing organic matter by incineration. Exclude flies from the home by the use of adequate screens. Destroy those that gain entrance as described under the control of the house fly.



Fig. 2—The blue-bottle fly, *Calliphora vomitoria* L., enlarged and natural size (authors' illustration).

BLOW FLIES

In general, blow flies are rather large, noisy, metallic blue or green insects, which deposit their eggs and develop in a variety of organic matter such as fresh and decaying meat, garbage and human faeces. They also lay eggs in wounds and sores in living animals and man, their larvae developing therein. This condition is known as myiasis and is discussed more fully on page 21.

Owing to their habit of frequenting faeces, diseased and decaying meat, other filth, wounds and sores, blow flies may transmit disease. They frequently enter dwellings in search of food and shelter during the spring and summer months, and deposit their eggs on exposed meat. There are a number of species of these flies in Canada. Two common species are the blue-bottle fly, *Calliphora vomitoria* L., and the green-bottle fly, *Lucilia caesar* L. The former species (fig. 2) measures about one-half an inch in length and has a bluish-black thorax and dark metallic blue abdomen; the latter is slightly larger than the common house fly and is of a brilliant bluish-green colour.

Control.—Dispose of carcasses and offal by burial or incineration. Prevent the flies from having access to human faeces in such places as open privies by treating the faeces with powdered borax or chloride of lime, covering the same with soil. Do not allow the accumulation of decaying organic matter in such places as municipal dumps, but dispose of it by burning. Protect open wounds and sores from flies. Do not expose meat where the flies may deposit their eggs on it. Use screens on doors and windows. Flies that have gained access to dwellings may be destroyed by spraying with the pyrethrum-kerosene spray described on page 11.

THE STABLE FLY, *Stomoxys calcitrans* L.

The stable fly is similar in appearance to the common house fly but may be distinguished from it by its awl-like proboscis. This species is most in evidence from July to October and commonly lives outdoors, entering houses for shelter in dull or stormy weather. Both sexes suck blood and attack domestic animals and man, inflicting a painful and irritating bite. The larvae breed in manure and decomposing organic matter.

Control.—The measures recommended for the control of the house fly (see p. 14) will prove equally efficacious in controlling this species.

FRUIT FLIES

Small, light reddish-brown flies may often be seen flying in numbers in dwellings about overripe or decaying fruit. These flies, which measure barely one-eighth of an inch in length, are fruit flies of the genus *Drosophila*. A common species, *D. melanogaster* Mgn., is shown in figure 3. Fruit flies lay their eggs and breed in decaying fruit, pickle mustard, fermenting liquids, etc., and their small, slender, white larvae or maggots sometimes may be found in large numbers in jars of preserved fruit and pickles, that have been left open or imperfectly sealed.

Owing to their small size it is difficult to exclude fruit flies from houses by means of ordinary fly-screens. They also may gain access in paper bags or other containers in which overripe or fermenting fruit is brought into the home. They reproduce rapidly, their entire life-cycle from egg to winged fly occupying less than two weeks.

Control.—Overripe or decaying fruit and other material such as

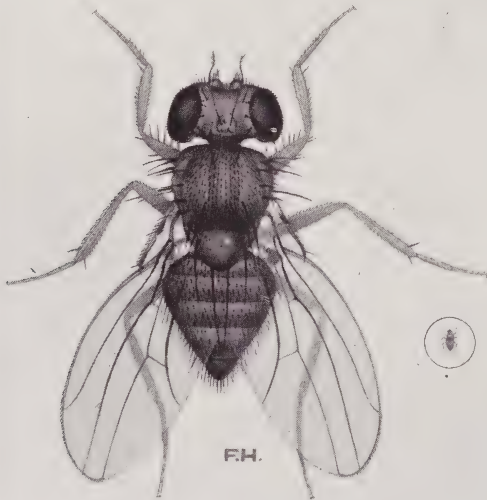


Fig. 3—The fruit fly, *Drosophila melanogaster* Mgn., enlarged and natural size; wings partly spread to show venation (original).

garbage in which the flies may breed should be removed and destroyed. Jars of preserved fruits should be hermetically sealed and when opened should not be left exposed where the flies may lay their eggs in the contents. The adult flies may be destroyed by spraying with pyrethrum-kerosene spray (see p. 11).

THE CHEESE SKIPPER, *Piophilæ casei* L.

The adult of the cheese skipper is a small, shining black fly about three-sixteenths of an inch long. The name "skipper" is applied to the white maggot of this fly owing to the fact that it possesses peculiar powers of leaping. The maggots are known to leap as far as four or five inches. The female fly lays her small eggs on exposed cheese, also on cured meats; these hatch into white maggots. It is unwise to eat cheese or meat infested with the living maggots (see under myiasis, p. 21).

Control.—Infested pantries and storerooms should be thoroughly cleaned, and liberally sprayed with pyrethrum-kerosene spray, or a spray containing derris extract (rotenone), paying particular attention to cracks in which the larvae or pupae may be overlooked. Where the flies are troublesome the rooms or receptacles should be screened with a fine mesh screen (24 mesh to the inch) to exclude them. Infested portions of cheese or meat should be cut out and destroyed.

MOSQUITOES

There are about sixty species of mosquitoes in Canada, many of which feed on the blood of man. Although the majority of them, particularly those of the genus *Aedes* (fig. 4), are most troublesome in field and woodland, in certain seasons they often cause considerable annoyance indoors as well. This is true especially in the case of summer cottages and unscreened dwellings situated in localities where mosquitoes are seasonally abundant. Their attacks are most noticeable at dusk and in warm, dull, humid weather. In autumn and winter complaints are frequently received of the presence of numbers of mosquitoes in cellars and basements. These mosquitoes are hibernating females of the genera *Culex* and *Anopheles* which pass the winter as winged adults in protected situations and attacks from them are rare. The more common mosquitoes, *Aedes*, are seen only during the warm months of the year as they overwinter in the egg stage out-of-doors.

In many parts of Eastern Canada, the cosmopolitan house mosquito, *Culex pipiens* L., is now well established, particularly in towns and cities, and in certain localities has become a decided public nuisance. This mosquito will breed in any stagnant bodies of water in the vicinity of houses and is most prolific in water polluted with sewage or other decomposing matter. Rain-water barrels are a common source of infestation. This species is rarely found far from dwellings which it enters freely, biting particularly at night.

Control.—All mosquitoes develop in more or less stagnant collections of water and the most satisfactory way of controlling them is to eliminate the breeding places by draining or filling, or to treat the surface of infested waters with petroleum oil of good spreading qualities. Such work is best conducted as a community enterprise. Householders may assist in such work and alleviate to some extent conditions in their own immediate vicinity by screening water containers and eliminating or oiling small bodies of water in which mosquitoes are known to be breeding. Doors and windows of dwellings should be properly screened, preferably with screens of not less than 16 meshes to the inch. Mosquitoes which have gained access to buildings may be destroyed by spraying with the pyrethrum-kerosene spray discussed on page 11.

A spray has been developed by Dr. J. M. Ginsburg, of the New Jersey Agricultural Experiment Station, for securing protection from mosquitoes for

short periods in limited areas outdoors. This is of particular value for garden parties and other outdoor gatherings. Such a spray may be prepared by thoroughly emulsifying one gallon of the pyrethrum-kerosene spray described on page 11, using one pound of pyrethrum powder to one gallon of kerosene, with one-half gallon of water in which has been dissolved four ounces of liquid cocoanut oil soap (40 per cent). This concentrated emulsion after being well shaken, should be mixed with 10 parts of water and sprayed in the form of a fine mist on lawns, shrubs, and other vegetation, by means of a portable or other pressure sprayer with a suitable nozzle. About 55 gallons of the diluted spray per acre has been recommended. To protect large gatherings such as

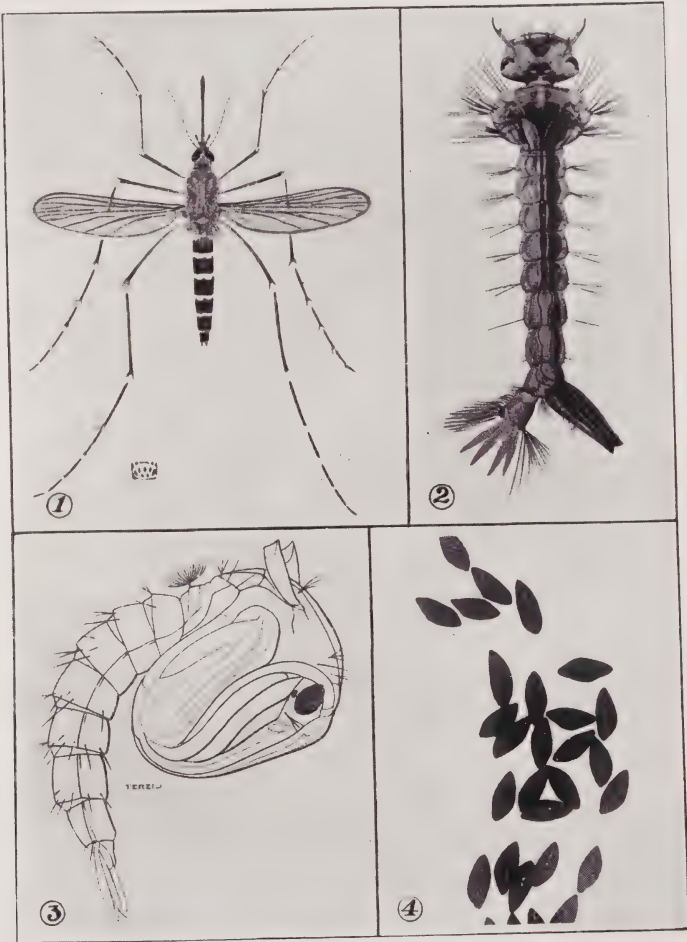


Fig. 4—Life-stages of a mosquito; 1, adult female; 2, larva; 3, pupa; 4, eggs; all of the genus *Aedes* (after Hearle).

garden parties and picnics, it is necessary to spray the whole area thoroughly with a power sprayer, before the people assemble, also directing the spray upward to saturate the atmosphere with a fine mist. This spray may be substituted for petroleum oil in treating water bodies to kill mosquito larvae and pupae, when it is desired to avoid possible injury to plant foliage, such as in ornamental ponds and similar places.

For other two-winged flies invading dwellings see also under cluster-fly, midges and other flies (pp. 72, 73).

MYIASIS

Myiasis is the term given to diseased conditions arising when the larvae of flies invade or attack the organs and tissues of living animals and man. There are a number of different species of flies that may cause myiasis. The larvae of blow flies, which normally occur in dead animal matter, on occasion have been found developing in neglected open wounds and sores and in the nasal passages of persons suffering from catarrh. Internal myiasis is sometimes caused by the maggots of certain species of flies invading the intestinal and urogenital tracts. In this connection, many species have been listed by various authors, including larvae of the common house fly, the lesser house fly, the latrine fly, the cheese fly (cheese skippers), syrphus flies (rat-tailed maggots), and others.

Prevention of Myiasis.—Myiasis usually occurs through carelessness or lack of cleanliness. The following precautions should be observed: Protect open wounds and sores from flies by antiseptic dressings. Thoroughly wash vegetables to be eaten raw, as it is possible for fly maggots to gain entrance to the intestinal tract on such food. Do not eat cheese or other food infested with living maggots. Avoid drinking water from a doubtful source unless it has been filtered or chlorinated. Screen sleeping infants from flies. Exclude flies from outside privies by adequate screens. Prevent the breeding of flies by destroying animal carcasses, other carrion and garbage by incineration, and by properly disposing of manure as described under the control of the house fly (see p. 14). In cases of myiasis promptly consult a physician for treatment.

2. Body Parasites and Wasps

THE COMMON BEDBUG, *Cimex lectularius* L.

The common bedbug occurs throughout Canada from the Atlantic to the Pacific. The exact date of its introduction from Europe is not known, but it probably established itself with the earliest settlers. It is found most commonly in old buildings, hotels and boarding houses, but may occur in dwellings of any kind. Its presence is rightly viewed with disgust and loathing owing to its bloodsucking habits and obnoxious odour.

Bedbugs (fig. 5) are oval, flattened, reddish-brown, wingless insects measuring about one-quarter of an inch in length when full grown. They possess piercing and sucking mouthparts and belong to the order Hemiptera or true bugs. They are nocturnal in habit, hiding during the daytime in cracks and crevices in walls, woodwork and furniture and behind pictures and under loose wallpaper. Both sexes feed on mammalian blood, particularly that of man and are capable of existing for long periods without food. They will migrate short distances in search of blood and consequently one infested apartment or flat is a continual menace to others in close proximity. The effect of their bites varies in different individuals, causing little or no discomfort in some, and swellings and inflammation in others.

The bedbug lays its small, white, elongate eggs in cracks and crevices used as hiding places. One female may deposit as many as 200 over a period of several months. In badly infested premises the eggs may be found in large numbers even on such places as blankets, mattresses, and the woodwork and springs of beds. The eggs hatch in from seven to fourteen days, or longer, depending on temperature conditions. The young nymphs on hatching from the eggs have the same general appearance as the mature bugs, but are smaller and paler in colour until after feeding. They molt or shed their skins five times before reaching maturity. At least one meal of blood is necessary between each molt. The life-cycle of the bedbug, from egg to adult, occupies from about six weeks to several months, depending on temperature and food conditions.

Control.—The control of bedbugs is most satisfactorily accomplished by fumigating with hydrocyanic acid gas (see p. 6) or by superheating (see p. 12). Fumigation with sulphur dioxide by burning sulphur (see p. 10). has been frequently recommended in literature, but in our experience has proved unsatisfactory. Experiments in the United States, on ships, showed that ethylene oxide-carbon dioxide (see p. 8) used as a fumigant at the rate of 6 lb. per 1,000 cubic feet is effective in destroying bedbugs. Other methods of control, slower in operation and less sure in results than those recommended above, are given in the following paragraph.



Fig. 5—The bedbug, enlarged and natural size (authors' illustration).

Spray all cracks and crevices in walls, woodwork, furniture, etc., wherever the bugs may hide, with the pyrethrum-kerosene spray discussed on page 11. Sprays containing derris extract (rotenone) are also effective. A very cheap spray may be made by adding eight fluid ounces of cresol to one gallon of kerosene. This forms a fairly good substitute for the pyrethrum spray when there is no objection to its carbolic odour, or to the possibility of staining materials. If desired, the cresol may be added to the pyrethrum spray. It is important to apply the sprays liberally and thoroughly to secure satisfactory results. Remove old, torn and loose wallpaper, and re-paper after thoroughly washing down the walls. Wherever possible fill up cracks in walls, floors and cupboards with putty, or a proprietary crack-filler, and complete the work with a coat of paint or varnish. To prevent the accidental introduction of these parasites into the home it is advisable to use caution in purchasing second-hand furniture, and to bear in mind that domestics living in less clean surroundings may sometimes be a source of infestation.

THE BAT BUG, *Cimex pilosellus* Horv.

The bat bug is closely allied to the common bedbug which it resembles and from which it can be distinguished with certainty only by the trained observer. This insect is an external parasite of bats, and sometimes causes alarm and annoyance by invading the living quarters of dwellings in which bats have established their roosts. We have several authentic records of such occurrences from British Columbia, Alberta, Ontario and Quebec, and it is probable that the species is widely distributed throughout the Dominion. It apparently does not readily attack humans.

Control.—Measures should be taken to eliminate bats from the premises as discussed in the section dealing with those animals on page 91. The liberal use of pyrethrum-kerosene spray should prove effective in destroying the insects. Other measures recommended for the control of the common bedbug may be followed if necessary.

THE SWALLOW BUG, *Oeciacus vicarius* Horv.

Occasionally we receive complaints of the presence of the swallow bug in houses. The insect is apparently widespread in Canada. Instances of this bug biting human beings have been recorded. It is normally a parasite of swallows.

The full-grown swallow bug is about half the size of the mature common bedbug. In general, it is similar in colour and appearance to the latter insect, and could not be distinguished therefrom by the casual observer.

Control.—Superheating, or fumigation, as recommended for the common bedbug, would also, of course, destroy infestations of the swallow bug. The removal of swallows' nests from houses as soon as the young birds are fledged and flying, followed by sweeping up and burning the nests and debris, and the liberal use of pyrethrum-kerosene spray in the vicinity, should be of value in preventing infestations in the home.

FLEAS

Fleas are frequently troublesome in houses particularly during the late summer and early autumn. They are small, hard-bodied, active insects, wingless, but possessing powerful legs well-fitted for jumping. Their mouthparts form a lance-like piercing organ with which they penetrate the skin of their victim and suck blood. Their laterally compressed bodies and the backward-projecting spines with which they are equipped are admirably adapted for allowing the flea to move rapidly among the hairs of its host. The cat flea, *Ctenocephalus felis* Curt., and the dog flea, *C. canis* Bouché (fig. 6), are the two species of fleas which have proved most troublesome in Canada. These insects, which normally infest cats and dogs, will readily attack human beings when hungry. They are most frequently complained of in this connection in late summer, usually by people returning from summer vacations and entering a house that has been unoccupied for several weeks. In temporarily vacant houses, undisturbed by the cleaning activities of the housewife, the fleas multiply rapidly, so that when the occupants return they are met by large numbers of these actively-jumping insects which attack them voraciously.

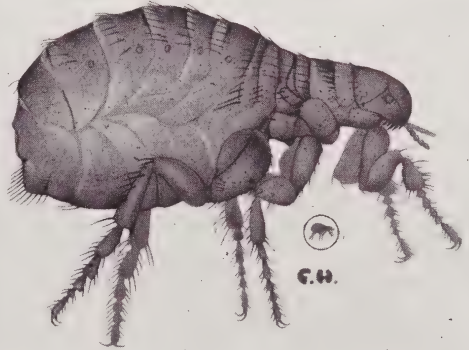


Fig. 6—The dog flea, enlarged and natural size (authors' illustration).

The life-history of these fleas is briefly as follows: The small, white, oval eggs are deposited loosely among the hairs of cats and dogs or in their sleeping places. The eggs drop or are shaken from the animals, and hatch into tiny, cylindrical, legless maggots which feed on various organic substances in floor cracks, under carpets, etc. On reaching maturity, the larvae spin small silken cocoons and transform into the pupal or resting stage, emerging later as adult fleas.

Fleas are obnoxious not only on account of their repulsive appearance and the discomfort caused by their bites, but also because they may transmit undesirable organisms and disease to human beings. Cat and dog fleas and the human flea mentioned below are numbered among the species of fleas which are carriers of bubonic plague, and they may convey other diseases. Moreover, they serve as the intermediate hosts of the dog tapeworm which is occasionally parasitic in man.

In addition to the cat and dog fleas, two other species known to attack humans occur in Canada, namely, the human flea, *Pulex irritans* L., and the European chicken flea, *Ceratophyllus gallinae* Schrank. The former has developed as a pest in recent years in widely separated localities in the provinces of Prince Edward Island, Quebec, Ontario, Manitoba, Saskatchewan and British Columbia, and may become an increasingly prominent household pest. The latter species which is a parasite of fowls and wild birds in the eastern provinces of Canada is rarely recorded attacking humans in dwellings, but may be a more common offender in this regard than our present records indicate.

Control.—As cats and dogs are usually the source of infestations, steps should be taken to rid them of fleas. This may be done by dusting the animals thoroughly, over newspapers, with fresh pyrethrum insect powder, or derris powder, which kills or stuns the fleas and causes them to fall on the paper, after which they may be destroyed by burning; or, the animals may be kept free by washing them occasionally in a solution of cresol, 2 per cent for cats and 3 per cent for dogs, followed shortly after by soap and warm water. The sleeping places of cats and dogs should be kept scrupulously clean. Dusting such places with fresh pyrethrum or derris powder prevents fleas from breeding.

To rid dwellings and other buildings of fleas, spray liberally the rooms and other infested places with pyrethrum-kerosene spray (see p. 11) to kill the adult fleas. This treatment should be accompanied or immediately followed by a thorough housecleaning, including scrubbing the floors with soap and hot water to destroy the immature stages (eggs, larvae and pupae) which may be present in floor cracks. The basement of the dwelling should be given special attention in this regard. When possible the use of a vacuum cleaner on floors, carpets and rugs is recommended. Other quick and effective methods are superheating (see p. 12) or fumigation with hydrocyanic acid gas (see p. 6). Even if either of the latter methods is adopted, there nevertheless should be a thorough cleaning of the premises. Particular attention, of course, should be given to the treatment of infested animals before permitting them to re-enter the treated building.

LICE

Lice thrive on people living in an unclean and crowded environment, but even the cleanest of persons may become temporarily infested by contact or association with their less clean fellows. There are two species of lice which feed on the blood of man. These are *Pediculus humanus* L., of which there are two varieties, namely, the head louse, *P. humanus humanus* L., and the body louse, *P. humanus corporis* DeG., and the crab louse, *Phthirus pubis* Leach.

Head and body lice are small, wingless insects, elongate-oval in shape, and one-sixth of an inch or less in length, varying in colour from whitish to brown. They are of importance not only from the standpoint of cleanliness and comfort,

and the possibility of secondary infection from scratching, but also because in many parts of the world they play a vital role in the dissemination of such diseases as typhus fever, relapsing fever and trench fever. The latter disease, which is spread by the excreta of lice, gained prominence during the World War, and was responsible for many casualties in the belligerent armies. Head and body lice are almost indistinguishable in appearance, but the head louse (fig. 7) is usually smaller, darker, and more active than the body louse. The head louse lays its tiny oval eggs or nits on the hairs of the head, and the body louse lays them on the clothing and hairs of the body.

The crab louse is smaller than either the head or body louse and in general appearance resembles a tiny crab. Its body measures about one-fifteenth of an inch in length and its legs are large in comparison to the size of the body, and clumsy in appearance, particularly the two hind pairs which are armed with strong claws well adapted for clinging to hairs. This species is not known to carry disease, but sets up irritation and fever by its feeding activities. It lives on hairy portions of the body, particularly about the pubic region and armpits, and its presence may be detected by the irritation set up and by the appearance of small irregular bluish spots on infested parts of the body. The crab louse adheres closely to the surface of the skin of its host where it embeds its mouth-parts, often remaining feeding in one place for several days.

Control.—To control body lice and crab lice the infested person should completely disrobe and place the clothing in a receptacle for subsequent treatment. The body, particularly the hairy parts, should be thoroughly treated with a 2 per cent lysol solution, pure kerosene, or kerosene emulsion prepared by thoroughly mixing together equal parts of kerosene and soft soap or olive oil. The latter is non-irritant and is, therefore, preferable. The effectiveness of this preparation may be increased by using kerosene containing pyrethrum extract (see p. 11). A material used in the British Army, known as naphthalene ointment, which is said to be very effective, is prepared by mixing four parts of naphthalene and one part of soft soap. In the case of crab lice, mercurial ointment is frequently recommended, but the use of this material is deprecated owing to its poisonous properties. The kerosene-soap emulsion containing pyrethrum extract should prove effective. Success has been reported from the use of kerosene-pyrethrum extract containing 1/10 of 1 per cent of cresol. Treatment with one of the above materials should be followed by the liberal use of soap in a hot bath. Shaving off the hair from hairy parts of the body renders the above treatment more efficacious and lessens the likelihood of re-infestation. Head lice and their eggs may be destroyed by treating the hair with the above-mentioned kerosene emulsion, or the emulsion containing pyrethrum extract, enclosing the head in a towel for an hour and following this by a thorough shampoo. Repeating the treatment in a week's time will destroy any lice that may have survived the first treatment. Where there is likelihood of infestation children's hair should be kept short, and the frequent use of a fine tooth comb is recommended. Rubbing the hair with vinegar before using the comb will loosen any nits which may be present. The head covering worn by infested persons should also be treated.



Fig. 7—The head louse, enlarged and natural size (authors' illustration).

Lice and their eggs on clothing may be destroyed by placing the clothing loosely in an oven and subjecting it to a temperature of 130° F., or higher, if this can be done without damage to the clothing, for a period of at least one-half hour. Under-garments may be boiled when there is no danger of shrinking, but woollens should be soaked in a 2 per cent lysol solution followed by a thorough washing in soapy water. The use of a hot iron on outer clothing, particularly along the seams, is also effective.

BITING LICE

The lice just discussed are sucking lice (Siphunculata). Biting lice (Mallophaga) commonly infest birds, but one species, *Trichodectes canis* DeG., sometimes infests dogs. As this louse is one of the intermediate hosts of the dog tapeworm which occasionally infests humans, it is well to eliminate it as soon as discovered. Rubbing derris or pyrethrum powder into the dog's hair as for dog fleas, and washing the animal in 3 per cent cresol solution followed by soap and plenty of warm water have proven effective.

WASPS

Wasps often occur in and about dwellings and when numerous may become a nuisance on account of their habit of stinging when annoyed. There are many species of social wasps particularly of the genus *Vespa*, which are known popularly

as yellow jackets and hornets (figs. 8 and 9), and which build their nests of paper (figs. 10 and 11) either underground, or about verandahs, eaves, or even suspended from ceilings or rafters. The black and yellow or steel blue, thread-waisted, solitary, mud-daubers or digger wasps also commonly occur about dwellings. Wasps are usually considered beneficial insects as they feed upon flies and other noxious insects and rarely attack humans without provocation. The ovipositor or egg-laying tube forms the sting and is possessed only by workers and queens. Normally the sting is used for killing or paralyzing the prey on which the wasps and their larvae feed. Wasps are also fond of sweet substances and are attracted to the juices of fruits, preserves, etc.



Fig. 8—Common yellow jacket, *Vespa* sp., enlarged and natural size (authors' illustration)

Control.—The use of screens on doors and windows and the stopping up of any holes through which the wasps may gain access will prevent the entrance of these insects into dwellings. When wasps are annoyingly abundant the nests should be discovered and the inmates destroyed after dusk when all have entered for the night. In the case of nests in the ground this may be done by pouring two or three fluid ounces of carbon bisulphide into the opening of the nest and covering it with an old coat or sacking to retain the fumes. Small nests suspended from rafters, verandah roofs, etc., may be treated by covering them for a short



Fig. 9—Common white-faced hornet, *Vespa* sp., enlarged and natural size (authors' illustration).



Fig. 10—Nest of common yellow jacket, *Vespa* sp., natural size (authors' illustration).

period with a large jar containing a small quantity of chloroform, afterwards removing the nests and burning them. With larger nests, attached to such places as the limbs of trees where this method is not practicable, the entrance to the nest may be stopped up after dark, and the whole, after being thoroughly soaked in kerosene, removed and burned. The pyrethrum-kerosene spray described on page 11 will destroy any wasps that gain entrance to dwellings. Stings may be treated by bathing with weak ammonia and applying hot compresses.



Fig. 11—Nest of common white-faced hornet, *Vespa* sp., one-third natural size (authors' illustration).

3. Insects Affecting Foodstuffs

In this section are considered those insects which attack materials used for food and either render them unfit for human consumption by pollution, or adversely affect them in quality and quantity. Such diverse forms as cockroaches, ants, beetles, and moths are included in this category. The combined attacks of these insects on foodstuffs are responsible for immense losses to Canada annually. Flies such as the house fly, blow flies, fruit flies and the cheese skipper fly, which also affect foodstuffs, are dealt with in a previous section under the heading "Two-winged Flies".

COCKROACHES

Cockroaches are frequently abundant in apartment houses, hotels, dwelling houses, stores and, in short, in any buildings where there are warm moist conditions and a plentiful supply of food. Sometimes during the summer months they live and multiply in garbage dumps, and have been reported invading dwellings from such places. These insects have flattened, horny bodies and large spiny legs which enable them to move quickly and take refuge in cracks and other small crevices in walls, floors, etc. In such places they usually remain hidden during the day and emerge at night to prowl about in search of food. Cockroaches are practically omnivorous and are particularly fond of foodstuffs favoured by man. On this account they are usually most numerous about kitchens and pantries and other situations where food is readily accessible.

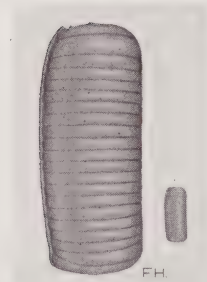


Fig. 12—Egg capsule of German cockroach, enlarged and natural size (original).

The eggs of cockroaches are developed within a small horny capsule or packet (fig. 12) which is deposited by the female usually in a warm moist place. Female cockroaches may be seen frequently with the egg capsule protruding from the end of the abdomen and these capsules are often dropped when the insect is threatened with danger. The young or nymphs which hatch from the eggs are similar in general appearance to the adult cockroaches, but are smaller and lack wings. In growing they shed their skins several times. Cockroach infestations often may be detected by the presence of cast skins and empty egg capsules on shelves and in cupboards, even when the living roaches have escaped notice. Cockroaches also emit a peculiar odour which is sometimes imparted to the food over which they have walked and even to crockery and other utensils, thus revealing their presence.



Fig. 13—The German cockroach, enlarged and natural size (authors' illustration).

The most prevalent species in Canada is the German cockroach, *Blattella germanica* L. (fig. 13). This cockroach is a small species measuring about five-eighths of an inch long when mature. It is light-brown in colour and bears two distinct dark-brown longitudinal stripes on the thorax. It is troublesome all the year round in heated buildings and is the species about which complaints are most frequently made. Another species, much less common than the foregoing, is the American cockroach, *Periplaneta americana* L. This insect is the largest domestic roach found in Canada. It measures about one and one-half inches in length, is light-brown in colour and possesses strong, well-developed wings in both sexes. The oriental cockroach, *Blatta orientalis* L., sometimes becomes established in Canadian dwellings. This species is dark-brown to

black in colour, and measures about one inch in length when mature. The female is practically wingless and the male has abbreviated wings. Another species, sometimes found on imported bananas, is the Australian roach, *Periplaneta australasiae* Fab. This species, in general appearance, resembles the American roach, but is smaller, measuring about one and one-quarter inches in length when full-grown. It is also distinguished by the presence of a narrow yellow stripe on the sides of the upper wings. Occasional complaints are received from points in Ontario and Quebec of the invasion of summer homes by the woodland cockroach, *Parcoblatta pennsylvanica* DeG. One correspondent stated that: "They get into everything, drawers, clean laundry, over clean dishes, tables, walls, floors; in fact, everywhere: even in the beds at times."

Control.—Cockroaches may be controlled readily by means of sodium fluoride. This material should be dusted lightly in places frequented by the roaches, such as about sinks, baseboards, cupboards, hot water pipes, etc., or it may be blown into cracks and crevices which shelter the insects, by means of an insecticide puffer or dust gun. The sodium fluoride adheres to the legs and antennae of the roaches, and in cleaning themselves the insects are poisoned by it. Sodium fluoride retains its effectiveness and may be left undisturbed as long as convenient or until the cockroaches have completely disappeared. As this chemical is somewhat poisonous reasonable precautions should be taken to prevent children or domestic pets from gaining access to it.

Two other materials which form the basis of many proprietary roach powders and which are often recommended, are pyrethrum and borax. Pyrethrum insect powder is less effective than sodium fluoride, it loses its insecticidal value rather quickly on exposure to air, and has to be used in larger quantity. Borax, also, is less satisfactory than sodium fluoride. It is easily obtainable, however, and mixed with equal parts of powdered sweet chocolate is a fairly effective remedy. Pyrethrum-kerosene sprays (see p. 11) forced into their hiding places are commonly used to control cockroaches. The addition of a small percentage of cresol has been reported to increase the effectiveness of the spray. Superheating (see p. 12) and fumigation with hydrocyanic acid gas (see p. 6) may be used to destroy cockroaches. In the case of hydrocyanic acid gas fumigation, however, there is a possibility of at least some of the eggs surviving.

ANTS

Although the majority of our Canadian species of ants live in colonies or nests outdoors they frequently cause annoyance by invading kitchens and pantries in search of food. One of the most common and troublesome house-

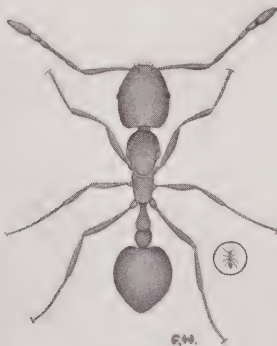


Fig. 14—Pharaoh's ant, enlarged and natural size (authors' illustration).

hold species, known as the red ant or Pharaoh's ant, *Monomorium pharaonis* L., confines itself entirely to heated buildings such as bakeries, restaurants, houses, public buildings, etc. This tiny, reddish-yellow ant (fig. 14) had its origin in the tropics. In figure 15 is pictured the common large black carpenter ant, *Camponotus pennsylvanicus* DeG. This insect, although normally an outdoor species nesting principally in decaying wood, frequently occurs in dwellings, particularly frame houses and summer cottages, and may cause injury to woodwork as well as annoyance by its presence. Another common species is the small yellowish-brown lawn ant, *Lasius niger* var. *americanus* Em., which nests in lawns and gardens often entering houses in search of food. The species *Formica fusca* L., is also an offender.

Ants are social in their habits, and live together in colonies. The majority of the ants in a colony and the ones most commonly seen, are wingless undeveloped female workers, which are incapable of reproducing their kind. Each colony also possesses one or more true females or "queens" which are responsible for the generation of new individuals. The white, helpless, larvae and pupae which develop from eggs laid by the "queen" are cared for by the workers which may be seen transporting them to a place of safety when the nest is threatened with danger. Ants that enter dwellings will feed on many kinds of foodstuffs, but are particularly fond of sweet and fatty substances.

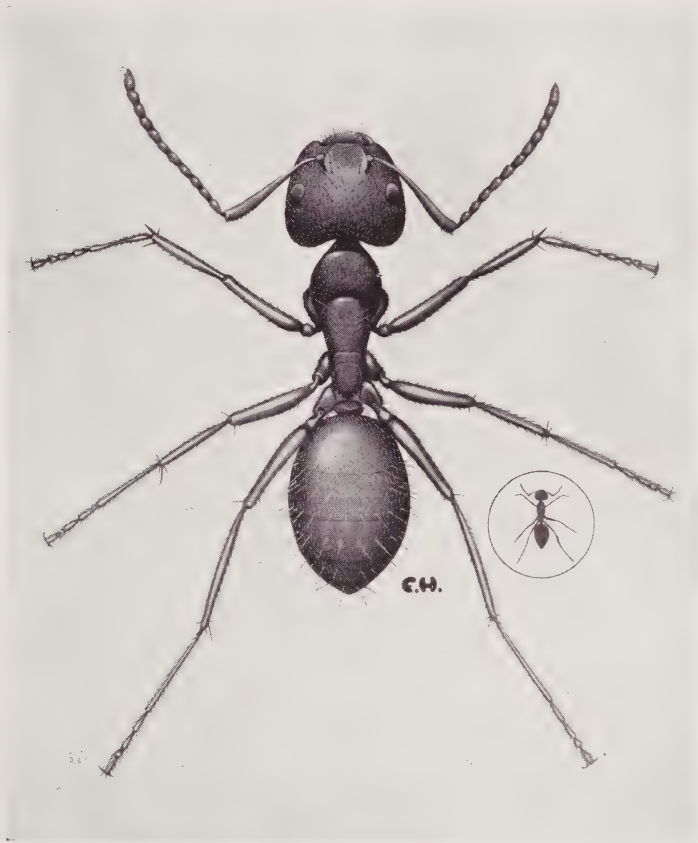


Fig. 15—The black carpenter ant, enlarged and natural size (authors' illustration).

Control.—The most satisfactory material so far discovered for destroying most species of ants found in dwellings is sodium fluoride, sold by druggists in the form of a fine white powder. This powder should be scattered lightly, or applied with a dust gun, in places frequented by the ants, and, preferably, should be left undisturbed until the insects have disappeared. As sodium fluoride is poisonous, care should be taken to prevent children or pets from gaining access to it.

As an alternative to the above, bait traps may be used. They may consist either of meat bones, or of sponges dipped in sweetened water. When large numbers of ants have collected on the bait traps they may be destroyed by immersion in very hot water. Pharaoh's ant is sometimes especially hard to eradicate. A bait trap which we have used with success against this species may be made by taking a small tin can with a tight lid, punching several holes in the sides, and introducing a small piece of sponge and a small quantity of a

syrup prepared by mixing 8 ounces of sugar and $\frac{1}{2}$ ounce of honey in 1 pint of hot water, and adding 2 grams of sodium arsenate, or 1 gram of sodium arsenite. The worker ants are greatly attracted to the bait, and take it to their nests to feed the larvae and the queens. Thus the whole colony is destroyed. A large bacteriological building in Montreal heavily infested with Pharaoh's ant was completely freed of the pest by distributing one or two bait tins in each room of the building. The ants had largely disappeared within a week of the start of the treatment. In using the above bait due cognizance should be taken of its poisonous properties.

Ants may be discouraged from entering houses by keeping shelves, tables and floors, in kitchens and pantries, as free as possible from crumbs and other food fragments, and by storing foodstuffs in ant-proof containers. In addition openings in floors and walls through which ants may gain entrance should be carefully plugged.

When it is possible to find the nest in the ground outside, the whole ant colony may be destroyed by puncturing its surface with holes and pouring in several tablespoonfuls of carbon bisulphide. Heavy gas is given off by this liquid and its effect may be enhanced by covering the nest with an old coat or sacking. Care should be taken not to expose carbon bisulphide near fire as it is very inflammable.

Calcium cyanide dust is frequently used for destroying ant colonies. Holes are punched in the nest several inches apart to a depth of about six inches; a teaspoonful of the dust is poured into each, and the holes are plugged with soil, and the nest covered with bags or similar material to retain the gas. The cyanide should not be allowed to come into contact with the grass as it may burn it. The quantity to use depends on the size of the nest. Calcium cyanide is extremely poisonous and should be handled with great care (see p. 7).

THE LARDER BEETLE, *Dermestes lardarius* L.

A common household pest in all parts of Canada is the insect known as the larder beetle. It is especially fond of animal food products such as ham, bacon and other kinds of meat, as well as cheese. Among other materials damaged are skins of various kinds and feathers. On more than one occasion, at Ottawa, large numbers of these beetles have been observed feeding on fresh and decaying meat. One house investigated was thoroughly overrun with half to full-grown grubs. The latter swarmed along baseboards, floor cracks, under carpets, behind furniture, in inverted lamp globes, in fact, everywhere from basement to attic. During recent years a number of complaints have been received, with specimens, of the larvae of this beetle boring into fibre-board materials used in the construction of dwellings.



Fig. 16—The larder beetle, enlarged and natural size (authors' illustration).

This beetle is from about one-quarter to three-eighths of an inch in length, shaped as shown in figure 16. In colour, it is blackish, with a transverse, wide, pale yellow band as indicated in the illustration. The grub of this beetle, shown enlarged and natural size in figure 17, is brown in colour, conspicuously hairy, and bears two rather stout spines on its back near the end of the body.

Occasionally other species of dermestid beetles and their grubs occur in dwellings. At Ottawa we have reared the hide or leather

beetle, *Dermestes vulpinus* L., from decaying meat. This species feeds on meat and other food materials of high protein content, but is not generally considered of much importance as a pest. In 1930, however, in Montreal, the grubs were found doing material damage by boring into the interior timbers of an abattoir to pupate. The species *Trogoderma versicolor* Creutz., is sometimes taken in dwellings and other buildings and will feed on a wide range of materials, including cereals and dried milk products. We have records of it occurring in Ontario and British Columbia. The species has one generation a year, the adults emerging (at Ottawa) in March. Three other species that are occasionally found, but are not important, are *Attagenus pellio* L., recorded from Nova Scotia, Quebec and Ontario, *Trogoderma ornata* Say, recorded in Ontario, and the red-legged ham beetle, *Necrobia rufipes* DeG. recorded in Ontario and British Columbia.

Control.—Portions of food found to be infested by the larder beetle or other species of dermestids, should be removed and destroyed and the pantry or storeroom thoroughly cleaned before materials are replaced. Every adult beetle observed should be killed. The pyrethrum-kerosene spray, described on page 11, has been found of value in destroying the grubs, the places frequented being liberally sprayed with the mixture. Openings to pantries or storerooms liable to infestation, should be screened to prevent the adult beetles entering. When houses become seriously infested, a sure remedy is to fumigate with hydrocyanic acid gas (see p. 6).

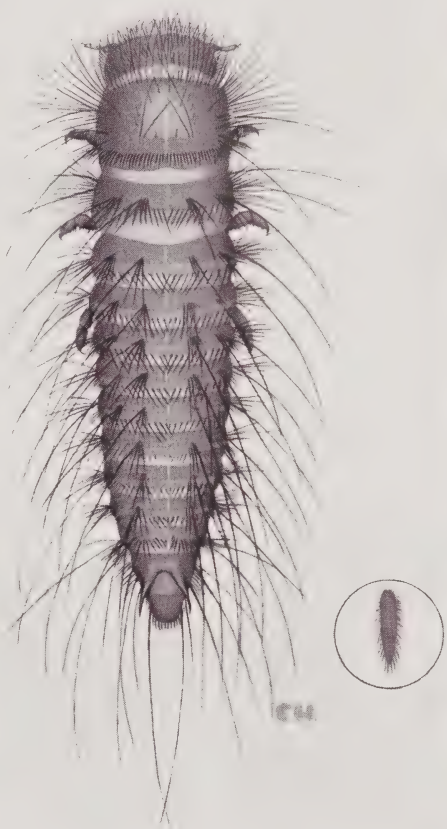


Fig. 17.—Larva of the larder beetle, enlarged and natural size (authors' illustration).

THE EUROPEAN EARWIG, *Forficula auricularia* L.

This important pest, which also occurs in northwestern portions of the United States, was first found in British Columbia in 1916, and since then has increased to an alarming extent, particularly in coastal parts of the province, necessitating the expenditure of large sums of money by affected municipalities.

In 1938, the insect was found to have established itself in Ontario, at Ayton, in Grey county. Young earwigs are white in colour, but soon become a grayish or olive shade. The mature earwig (fig. 18) is about five-eighths of an inch in length, and is a dark reddish-brown colour, the legs, the feelers and the small wing-covers being yellowish-brown. At the end of the body are a pair of so-called pincers or forceps.

Not only do the earwigs feed on garden plants of many kinds, but they enter houses and are found in bread and cake boxes, hiding in head lettuce, crawling around in bedrooms and other parts of the house—all to the disgust of the occupants. The insect has established itself in certain residential sections to such an extent as to seriously affect the value of property.

Control.—The following poisoned bait mixture is recommended for the destruction of this pest:—

Sodium fluoride.....	12 ounces
Molasses.....	1 quart
Bran.....	12 pounds
Beef scrap or meat meal.....	2½ pounds
Water.....	6 quarts
(approximately)	

Soak the beef scrap in the water for three hours or more before using it. Dissolve the sodium fluoride in the liquid; add the molasses, and mix with the bran to make a crumbly mash. Scatter the mixture thinly on warm evenings throughout the summer.

Thirty pounds is about sufficient to treat an ordinary city lot. If the earwigs are very numerous, several applications at weekly intervals may have to be made. The bait is ineffective after it has dried out in the sun, or after heavy rain. Watering the garden should not be done for two or three days, or, if it is done, care should be taken to avoid wetting the bait. Children, poultry and domestic animals should be prevented from having access to it.

THE INDIAN MEAL MOTH, *Plodia interpunctella* Hbn.

Among the true caterpillars found infesting dry food products in the home, the Indian meal moth (fig. 19) is one which effects serious damage. The caterpillar of this species and that of the Mediterranean flour moth, *Ephestia kuehniella* Zell., discussed below* are very similar. Both are whitish or flesh coloured with a reddish-brown head, and in length, about half an inch when mature. The Indian meal moth, with wings expanded, measures about five-eighths of an inch. The outer two-thirds of the front wings are of a coppery-brown colour, the other third near the body being cream-coloured. The hind wings are grayish, paler towards the base. The caterpillars, hatching from the small white eggs laid by the female moths, feed on a variety of substances, such as nuts, raisins, currants, oatmeal, dried fruit, etc. (fig. 20). Materials bought in the trade are not infrequently found to be infested, and in this way the pest is very often introduced into the home.

* Writing of distinguishing characters, Riley (Insect Life, II, 171) says: "The larvae of *kuehniella* are more slender and of a more uniform diameter than those of the other species. The abdominal legs are longer, cylindrical, with a circular fringe of hooklets at the crown. In *interpunctella*, the legs are short, conical, with the fringe of hooklets at the crown oval. All piliferous warts in *kuehniella*, most of which are rather minute, are still rather prominent, readily observed, and of a black or brown colour. Those most conspicuous are the lateral ones, in front of the first spiracle; the sub-dorsal one, each side of the mesothorax, almost completely encircled by a narrow, black ring interrupted only at its upper margin. In *interpunctella* all the warts, while present, are concolorous with the rest of the body, and can be distinguished only with great difficulty. The surface of the body of *kuehniella* is almost perfectly smooth, while that of *interpunctella* is somewhat granulate."

The sections on the control of this insect and the species on pages 35-43 were revised by H. E. Gray, in charge of stored product insect investigations, Division of Entomology, Ottawa.

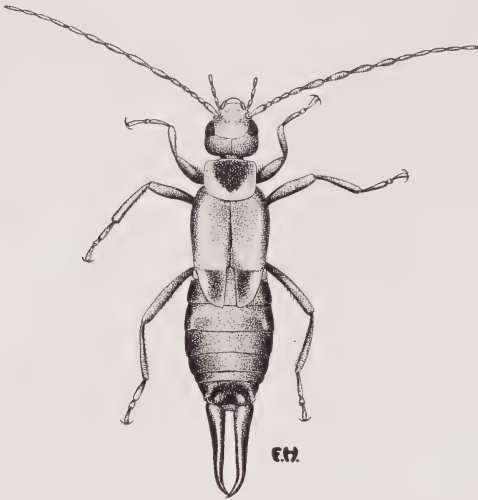


Fig. 18—The European earwig, enlarged four times (after Gibson).

Control.—During the winter, small quantities of infested foodstuffs may be treated by exposing them to low temperatures outdoors in mouse- or rat-proof receptacles. When the temperature goes below zero, a 24-hour exposure should be sufficient to kill any insects present. When it does not reach zero, a two- or three-day exposure is recommended.

During the summer, the most satisfactory procedure is to place the foodstuffs in an oven for an hour or two at a temperature of 130° to 140° F. With small quantities of material the eggs and larvae will be quickly killed at this temperature. Flour so treated will be quite free from insects after sifting. Fruits and nuts may be placed in cold storage to prevent the development of pests.



Fig. 19—The Indian meal moth, enlarged and natural size (authors' illustration).



Fig. 20—Raisins infested with caterpillars of the Indian meal moth (authors' illustration).

Housewives can do much to avoid losses due to this and other species of insects infesting foodstuffs by observing the following simple precautions: 1, purchase materials such as flour, rolled oats, cornmeal, other cereal and grain products, dried fruits, etc., in small lots, to ensure that they are consumed fairly promptly; 2, carefully examine all such foodstuffs at the time of delivery, to be sure that they are free from insect pests, and 3, store these supplies in tightly-sealed containers, such as glass sealers of appropriate sizes, equipped with rubber rings. In addition to being insect-tight, the glass jars help to preserve the original essences, and enable the contents to be seen at a glance. Many metal containers sold for the purpose are useless because of the ease with which insects may gain access to the contents. The advantage of insect-tight storage is two-fold. If the product is free from insects when placed in storage it will be completely protected from infestation while in the home. If the material is infested at the time of purchase, damage will be restricted to the food in the sealer, instead of spreading to other unprotected supplies.

THE MEDITERRANEAN FLOUR MOTH, *Ephestia kuehniella* Zell.

This well-known pest of flour mills (fig. 21) is not infrequently found in houses, particularly in flour. Containers which are kept in constant use, do not as a rule harbour infestations. In addition to flour, bran and other cereals are attacked. The caterpillar, when mature, is from about half an inch to three-quarters of an inch in length. The descriptions given in the footnote on page 34

should distinguish it from that of the Indian meal moth. The moth (fig. 22), too, is quite distinct, being larger, about half an inch in length, with all wings of a grayish colour, the front ones darker than the hind ones. The caterpillars

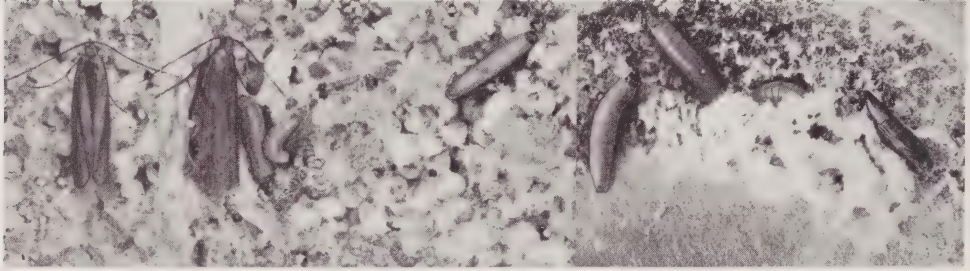


Fig. 21—The Mediterranean flour moth, adults and larvae in barley and flour, somewhat enlarged (authors' illustration).

have the habit of spinning silken threads and tunnels amongst flour and other manufactured cereal in which they are feeding.

Control.—Same as for the Indian meal moth (see p. 35).

In addition to *Ephestia kuehniella* Zell., there are three other species of the same genus, the caterpillars of which may occasionally be found causing limited injury in the household. These are:—

Ephestia elutella Hbn.

We have records of the caterpillar of this species, which is widespread in occurrence, feeding on nuts, linseed and flaxseed meal. It is also known to feed on biscuit, chocolate, figs, etc. In general, the caterpillar and also the moth are similar in appearance to the Mediterranean flour moth, but are smaller.



Fig. 22—The Mediterranean flour moth, enlarged and natural size (authors' illustration).

Ephestia cautella Walk.

This also is not, as yet, a pest of any importance. It is known, in Canada, to have attacked nuts, such as almonds and walnuts, and in the United States is recorded as feeding particularly on figs. This caterpillar is, in general, similar to that of the Mediterranean flour moth, and the moth is also like that of the latter species, but smaller.

Ephestia figulella Gregson.

The records we have of this species in Canada are few in number and relate only to the caterpillars feeding on imported figs. In addition, however, the

insect is known to feed on oatmeal and dried fruits, and undoubtedly attacks other foods. The caterpillar and moth are, in general, very much like those of the preceding species.

Control.—Should these additional species develop into pests of importance, the remedies recommended for the Indian meal moth (see p. 35) would be applicable.

THE YELLOW MEAL WORM, *Tenebrio molitor* L.

This species is common and widespread in distribution. Owing to their size, both the beetle and the grub are easily seen by the housekeeper and as a rule are quickly destroyed. The insect breeds readily in meal and flour, and if these foods are left exposed and undisturbed for a time, it is surprising how easily an infestation may develop. The beetle is attracted to lights at night and gains access to the home through open windows or doors.

The grub (fig. 23) somewhat resembles the common wireworm, being hard, yellowish in colour, shining, with reddish-brown transverse bands near where



Fig. 23—Yellow meal worm, adult and larvae in flour (authors' illustration).

the segments join. Mature specimens measure one and one-eighth inches in length. The beetle (fig. 24), which lays its small, white eggs in meal or other food, is from one-half an inch to over five-eighths of an inch in length. It is almost black in colour, some specimens being of a reddish-brown shade.

Control.—The heat treatment recommended for the Indian meal moth (see p. 35) is effective. The larvae are quite resistant to low temperatures.

THE DARK MEAL WORM, *Tenebrio obscurus* Fab.

To the housekeeper, this insect, in both the beetle and grub stages, will look the same as the preceding species, the yellow meal worm. The entomologist can easily find characters which will separate the species, but these need not be related here. The dark meal worm has only occasionally been reported a household pest in Canada. In 1934, it occurred abundantly in a dwelling in Hamilton, Ont. It feeds on meal, flour, bread, cake and cereals.

Control.—Same as for the yellow meal worm.

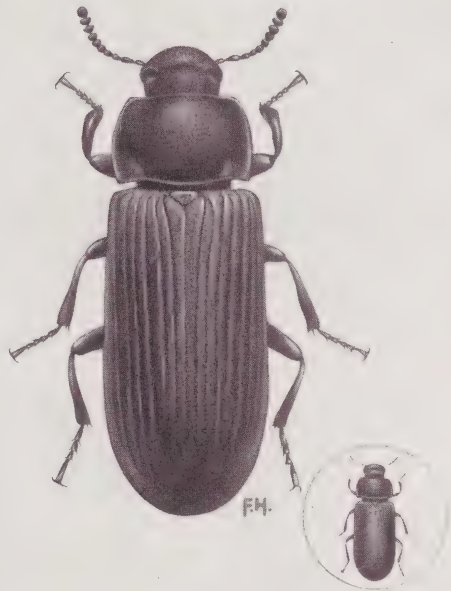


Fig. 24—Adult of yellow meal worm, enlarged and natural size (authors' illustration).

THE GRANARY WEEVIL, *Sitophilus granarius* L.

While this insect is not primarily a household pest, it is sometimes found by the housewife in macaroni. Occasionally it may be found in flour, meal, and other cereals, but is unable to breed therein, unless they are caked to a hard consistency. The insect is a rather common pest in storehouses and other places where grain is kept. The beetle (fig. 25) is from one-eighth to one-sixth of an inch in length, of a dark, shiny, mahogany-brown colour, with the head prolonged into a slender snout. Some specimens are almost wholly black. Having no wings beneath the hard wing-cases, it is unable to fly. In wheat and other small cereals, a single grub inhabits a grain, but a kernel of corn furnishes food for several individuals. The mature beetles also feed upon the grain and live for a long time, so that, in warm places where grain is kept in store for a length of time, the injury may be considerable.



Fig. 25—The granary weevil, enlarged and natural size (authors' illustration).

Control.—Experiments have shown that carbon bisulphide-carbon tetrachloride mixture will kill all the insects without injury to the grain as to either its wholesomeness for food or germination qualities for seed. The temperature should not be less than 65° F. Because of fire and explosion hazard the use of carbon bisulphide alone is not advised. Small lots of infested grain may be treated in an ordinary coal-oil barrel, which will hold about five bushels. Three or four ounces of either of the above mixtures applied either on the top of the grain, or in a shallow receptacle, will ensure satisfactory results. Care must be taken to close the top of the barrel tightly. This is best done with a cap made specially for the purpose, but also may be accomplished with fine sacks laid smoothly on the top, over which boards are laid with a considerable weight on them to hold the covering down closely. The fumigation should last for

48 hours. As an added precaution, if a light is necessary use a flashlight, and avoid smoking nearby during the treatment. For small lots of household materials, the measures discussed under the Indian meal moth may be followed (see p. 35).

THE RICE WEEVIL, *Sitophilus oryzae* L.

This insect has a close resemblance to the granary weevil in appearance and habits, though slightly smaller. Unlike that species it possesses fully developed wings. In colour it is a dull reddish-brown, and there are usually two lighter spots on each wing-case (fig. 26). It is often found injuring grain in company with the granary weevil. Like the former it can breed only in hard materials, such as whole grains (fig. 27), rice, spaghetti, etc., although sometimes it feeds on flour and other meal products.

Control.—Same as for the granary weevil.

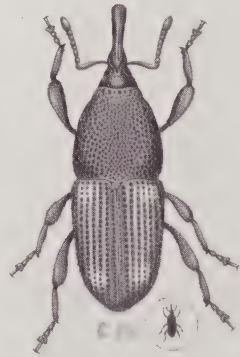


Fig. 26—The rice weevil, enlarged and natural size (authors' illustration).

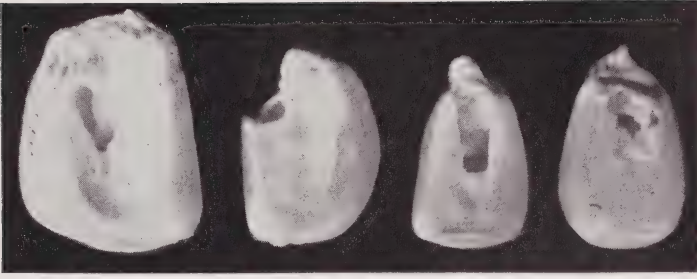


Fig. 27—Corn seeds injured by the rice weevil (authors' illustration).

THE SAW-TOOTHED GRAIN BEETLE,

Silvanus surinamensis L.

This insect, although called a grain beetle, is a common household pest, feeding in both the larval and adult stages on a variety of foodstuffs, including meal, flour, manufactured cereals, bread, cake, dried fruits, nuts, sugar, starch, candy bars, etc. Owing to their small size and active nature the beetles penetrate readily into many packages. A specimen is shown in figure 28, enlarged and natural size. It is of a reddish-brown colour. The common name for the insect was given on account of the saw-like appearance of each side of the thorax. The grub of this beetle is pale in colour, the upper surface or back bearing a series of darkened areas, one on each segment; near the head these dark areas may be divided by a pale line.

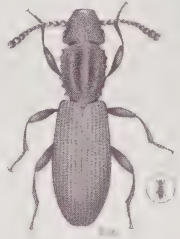


Fig. 28—The saw-toothed grain beetle, enlarged and natural size (authors' illustration).

Control.—Same as for the granary weevil (see p. 38).

THE MEAL MOTH, *Pyralis farinalis* L.

Some years this insect causes damage to stored grain and foodstuffs manufactured therefrom, particularly if damaged by moisture. It is not infrequently found in the holds and bilges of grain boats, where damp or moulded grain has accumulated, and has been reported causing serious damage to hay in the stack in the United States. The caterpillar is greyish-white in colour, with a brown head, and when full-grown is about half an inch in length. It spins considerable silk, fastening the food therewith in the form of tunnels in which it lives. These tunnels are readily apparent.

The moth, with its wings spread, is from about three-quarters of an inch to one and one-eighth inches in width. The basal and outer areas of the front wings are of a brown or reddish-brown shade, the central area being paler brown or yellowish-brown. The hind wings are pale brown or yellowish-brown. Crossing all wings are two irregular white lines. This insect, as yet, cannot be regarded as a serious pest in Canada.

Control.—Same as for the Indian meal moth (see p. 35).

THE EUROPEAN GRAIN MOTH, *Tinea granella* L.

This insect is not a pest of importance in Canada. We have only a few records of it occurring as a household pest, mainly in flour. While apparently able to feed on sound material, it is not infrequently found in damp and mouldy grain. The caterpillar is pale coloured, small, measuring about one-quarter of an inch long. The moth, with the wings spread, is about half an inch wide. The front wings are white with distinct dark brown areas and blackish spots; the hind wings paler brown without markings.

Control.—Same as for the Indian meal moth (see p. 35).

THE ANGOUMOIS GRAIN MOTH, *Sitotroga cerealella* Ol.

This moth is of a grayish-brown or straw colour, with a wing expanse of about half an inch. Its white caterpillar is occasionally found in shipments of corn seed imported from foreign countries. We have no record of it having developed into a household pest in Canada, nor is it likely to do so. It is especially destructive in southern sections of the United States.

THE SPIDER BEETLES

The insects known as spider beetles are responsible for considerable damage to cereal products and seeds of all kinds, while in storage in warehouses or in the home. The larvae at times bore into paper and wood, and occasionally cause damage to fabrics. There are several species in Canada, but only the more common ones are discussed here. Several of the species are very similar in appearance and habits.

THE WHITE-MARKED SPIDER BEETLE, *Ptinus fur* L.

Such foods as flour, corn meal, bran, etc., are attacked by this insect. The beetle is spider-like in form, reddish-brown in colour with four irregular white patches, two on each wing cover. In some specimens, these white patches are more distinct than in others and form almost a continuous band across the insect. In size, this beetle varies from a little less to a little more than one-eighth of an inch in length. Its grub is small, and white in colour.

THE HAIRY SPIDER BEETLE,

Ptinus villiger Reit.

Since 1924, this insect has been an important pest of flour and other cereal products in the Prairie Provinces. It also occurs in many warehouses in Ontario and Quebec. The small, whitish grubs are sometimes found by the housewife when sifting flour prior to baking. The adult beetle (fig. 29) is similar in general appearance, size and colour to the white-marked spider beetle.

THE EASTERN SPIDER BEETLE,

Ptinus raptor Sturm.

This species is a newcomer to Canada, apparently of European origin. It is already quite widespread in the Maritime Provinces and, to a lesser extent, in Quebec and eastern Ontario. In appearance and habits it closely resembles the hairy spider beetle.

THE GOLDEN SPIDER BEETLE, *Niptus hololeucus* Fald.

Occasionally, in various parts of Canada, a species of beetle known as the golden spider beetle has been found in houses, sometimes in considerable numbers. It has also, at times, been associated with cereal products. In 1931, specimens were found in chicken feed at Winnipeg, Man. It is a pest of considerable importance in Europe, where a wide range of materials is infested, and household provisions and spices, and even woollens and artificial silk are attacked. The beetle is about one-eighth to one-sixth of an inch in length, of a satiny brass colour, and somewhat more rounded in outline than the hairy spider beetle shown in figure 29, the entire body being covered with long silky hairs and fine scales.

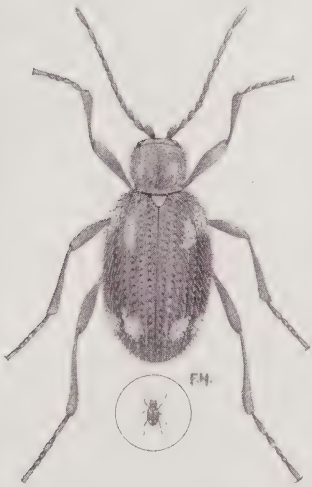


Fig. 29—The hairy spider beetle, enlarged and natural size (authors' illustration).

THE BROWN SPIDER BEETLE, *Ptinus brunneus* Duft.

This species is not so common in Canada as the white-marked spider beetle. It differs from the latter species chiefly in the absence of the white patches on the wing covers. We have no records of this insect occurring as a household pest in Canada, but in the United States it is claimed to have habits similar to those of the foregoing species.

THE GLOBULAR SPIDER BEETLE, *Trigonogenius globulum* Sol.

This is a rather rare species of spider beetle occasionally found in household commodities, including cayenne pepper, and dried hellebore, as well as cereal products. This beetle is similar in size and shape to the golden spider beetle, but in colour is pale brown, blotched with black.

THE SHINY SPIDER BEETLE, *Mezium americanum* Lap.

This odd-appearing beetle, with its rounded abdomen of shiny dark-brown, and thick covering of yellowish-white hairs on the head and thorax, is so spider-like in appearance as to suggest the name for the group. This insect frequents basements and at times becomes very abundant. There are several records of infestation of cereal warehouses by this pest.

Control of Spider Beetles.—Unlike most stored product pests the spider beetles are very resistant to low temperatures. Hence, exposing the infested commodities to outside temperatures is not effective against these insects. However, the heat treatment recommended for the Indian meal moth (see p. 35) is quite effective. The insects may be removed from the product in many cases by the use of a suitable sieve. Where infestations are severe, and the beetles are moving about at large, the use of a pyrethrum spray (see p. 11) is recommended.

THE CADELLE, *Tenebroides mauritanicus* L.

This well-known beetle is not an important household pest. It is frequently found in mills and warehouses, usually attacking the grain and coarser products. Of human foodstuffs, farina is the one most frequently infested. The grub is whitish in colour with a reddish-brown head; patches of the same colour are present behind the head, as well as at the end of the body. In length, the grub, when mature, is about three-quarters of an inch. The beetle is rather less than three-eighths of an inch in length. It has a somewhat flattened appearance and, in colour, is dark brown and shining.

Control.—Same as for the Indian meal moth (see p. 35).

THE CONFUSED FLOUR BEETLE,

Tribolium confusum Duv.

This small beetle (fig. 30), reddish-brown in colour and one-eighth of an inch long, is common in flour mills and also in other places where manufactured cereals are stored. It is probably the pest of cereals most frequently observed by housewives. In addition, it is known to feed on such products as dog biscuits, meal, nuts, corn, beans and other seeds. As the insect breeds readily in warm rooms, infestations may be found during the winter months in places where flour or meal is left exposed. The eggs are laid in or on the food, and the young, pale yellowish grubs, on hatching, begin to feed at once.

Control.—Same as for the Indian meal moth (see p. 35).

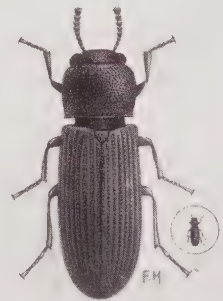


Fig. 30—The confused flour beetle, enlarged and natural size (authors' illustration).

THE RUST-RED FLOUR BEETLE, *Tribolium castaneum* Herbst.

There is little difference in appearance between this species and the preceding species. In size, colour and habits, both insects are similar. Fortunately, the rust-red flour beetle is apparently not common in Canada. As a household pest it is practically of no importance.

Control.—Should it ever develop in any part of Canada as a pest of importance, the control measures referred to under the Indian meal moth should be resorted to (see p. 35).

THE BEAN WEEVIL, *Mylabris obtectus* Say.

Dried beans bought in the trade are sometimes found to be infested (fig. 32) with the bean weevil, a small hard-shelled, gray-brown beetle (fig. 31), one-tenth of an inch long, oval in form, with the head prolonged into a squarely-cut snout or beak. The insect breeds readily under warm conditions, and will continue to be active while the supply of dry seeds lasts. The beetle is capable of

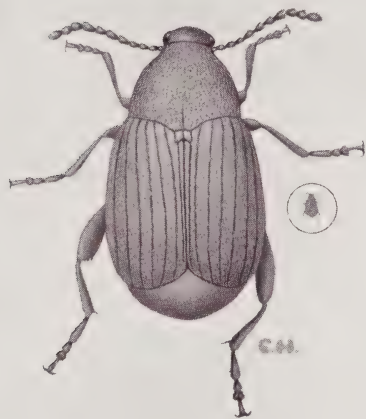


Fig. 31—The bean weevil, enlarged and natural size (authors' illustration).

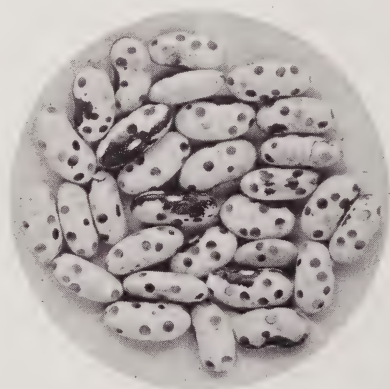


Fig. 32—Beans showing injury by the bean weevil (authors' illustration).

eating its way through cotton or paper bags in which beans are stored, and when this happens the pantry or other storehouse may become overrun with the insects. The grub is white with a yellowish head. Several specimens of the insect may be found within a single bean.

Control.—Same as for the Indian meal moth (see p. 35). Infested beans, of course, should not be used for seed purposes.

THE BROAD-BEAN WEEVIL, *Mylabris rufimanus* Boh.

We have occasionally received lima and broad beans which were infested with this weevil. These infestations, our records indicate, relate to imported seed. The insect has never become established in Canada, but in the United States it is recorded as occurring in California. This species is larger than the bean weevil and darker in colour, but otherwise much the same in appearance.

Control.—Consignments of beans found to be infested should be treated, as recommended under the Indian meal moth (see p. 35).

Two other species, namely, the four-spotted bean weevil, *Mylabris quadrimaculatus* Fab., and the cowpea weevil, *Mylabris chinensis* L., are also infrequently found in imported beans, but neither is a pest in Canada. Both species are slightly smaller than the bean weevil.

THE DRUG STORE BEETLE, *Sitodrepa panicea* L.

As mentioned on page 55, the drug store beetle commonly attacks food-stuffs. Flour, meal, bread, chocolate, pepper, ginger, rubbed parsley for seasoning, etc., are readily eaten. The statement has been made that it will "eat anything except cast iron." Chittenden in writing of this species says that "a whole chapter could be devoted to the food material of this insect, as nothing seems to come amiss to it and its voracious larva."

Control.—When foodstuffs are found to be infested by this insect, we would recommend the control measures advocated for the Indian meal moth (see p. 35).

THE CIGARETTE BEETLE, *Lasioderma serricorne* Fab.

Although tobacco is a favourite food of this insect (see p. 55), various other products are also attacked. Of household supplies, according to Chittenden, it has been found infesting cayenne pepper, ginger, rhubarb, rice, figs, yeast cakes and prepared fish food.

Control.—The same as for the Indian meal moth (see p. 35).

THE BLACK CARPET BEETLE, *Attagenus piceus* Ol.

This well-known pest of carpets, furs, etc., which is discussed on page 48, also breeds in flour and other manufactured cereals and attacks various kinds of seeds, such as pumpkin and timothy.

Control.—Foodstuffs infested with the grubs of the black carpet beetle may be treated in the same manner as recommended for the Indian meal moth (see p. 35).

THE VARIED CARPET BEETLE, *Anthrenus verbasci* L.

This species, discussed as a pest of woollens and silk goods (see p. 48), has been reported in Europe and the United States as feeding on various cereals and cereal products. At Ottawa, larvae of this species have been found to feed readily on a mixture of finely ground wheat, oats, barley, corn, soya bean and pea meal.

Control.—Infested foodstuffs may be rid of this insect by using the measures recommended under the Indian meal moth (see p. 35).

See also: house fly (p. 13); lesser house fly (p. 16); latrine fly (p. 16); blow flies (p. 17); fruit flies (p. 18); cheese skipper (p. 19); silverfish (p. 53), and the chapter on Insects Likely to be Brought into the Home on Fruits and Vegetables (p. 63).

INSECTS AFFECTING CLOTHING, CARPETS, UPHOLSTERED FURNITURE, ETC.

CLOTHES MOTHS

Clothes moths annually cause much damage in Canada to materials of animal origin, such as woollens, furs, hair, feathers, etc., and their ravages to articles of clothing, upholstered furniture, piano felts, carpets, etc., are familiar to everyone. Damage by clothes moths is caused by the feeding activities of the larvae or caterpillars of these insects, not by the winged moths whose principal function in life is to mate and deposit the eggs from which the larvae develop.

Two species occur in Canada, the webbing clothes moth, *Tineola biselliella* Hum., which is the more common and destructive, and the case-making clothes moth, *Tinea pellionella* L. The adults of both species are small moths having a wing spread of one-half inch or less. They are similar in general appearance and habits, but differ slightly in colour, the webbing species (fig. 33) being

entirely pale buff or straw colour and the case-making species grayish-yellow or dark buff with fairly distinct dark spots on the forewings. Both species avoid bright light and are most commonly seen in dwellings at night, flying in dimly-lit corners. They occur in greatest numbers in spring and summer, but occasional specimens may be seen in heated dwellings at any time of the



Fig. 33—The webbing clothes moth, enlarged and natural size (authors' illustration).

year. The winged moths do not feed, but during their brief life, which varies in length from a few days to a month, they deposit tiny, oval, pearly-white eggs (fig. 34), sometimes as many as 150, among the hairs or meshes of the material on which the larvae later feed.

The eggs hatch in from a week to ten days and the young larvae, which are very sensitive to light, seek out protected situations in the folds of fur and woollen garments, or in the interior of upholstered furniture, and commence feeding immediately. Clothes moth larvae have pearly-white bodies and pale brown heads. When mature they measure about one-half of an inch in length. The life of the larvae varies from a few weeks to as long as nearly two years, and they may be found in all stages of development throughout the year. As they feed and grow, they moult or shed their skins several times. The larvae of the two species differ markedly in their habits and thus may be readily distinguished. The larvae of the webbing clothes moth (fig. 34) move about freely and spin silken threads promiscuously on infested fabrics, often forming unsightly webs. They construct flimsy tube-like silken shelters into which they retire frequently and where they shed their skins, and finally pupate before the emergence of the winged moths. Larvae of the case-making species

construct small cylindrical cases of tightly woven silk and fragments of the material on which they feed (fig. 35). Throughout their life they live within the case, and in feeding, protrude the forepart of the body and drag the case about with them. Eventually they pupate within the cases and shortly afterwards the winged moths appear.

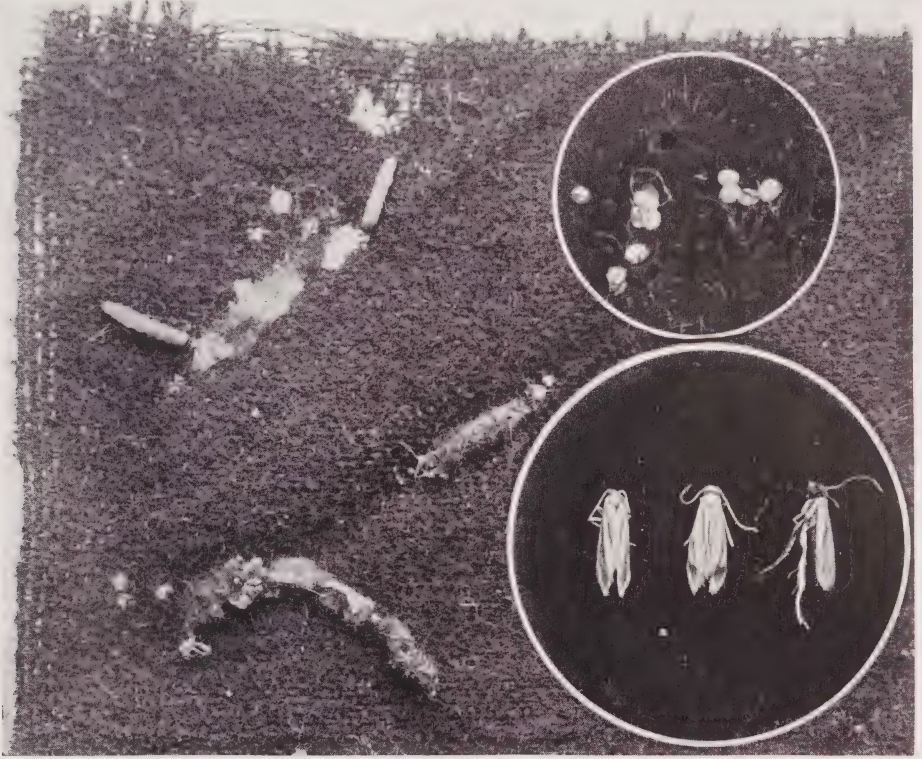


Fig. 34—Webbing clothes moth: eggs (much enlarged), in upper circle; moths, in lower circle; caterpillars and larval shelters on cloth—all somewhat enlarged (authors' illustration).

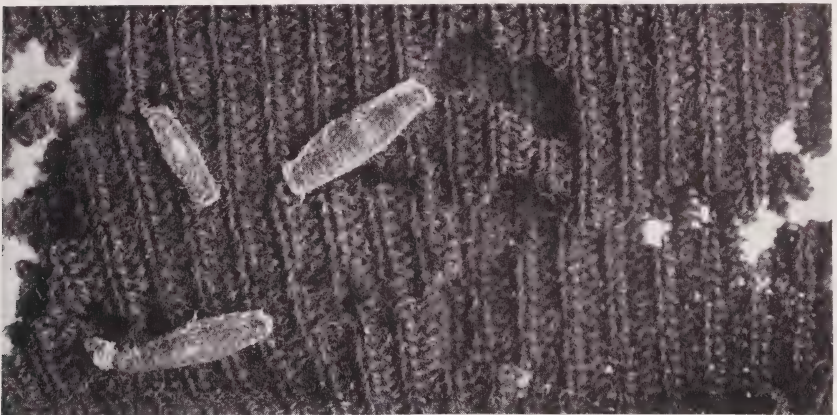


Fig. 35—Larval cases and work, on woollen glove, of the case-making clothes moth; somewhat enlarged (authors' illustration).

Control.—The prevention of damage by clothes moths requires the exercise of care, forethought, and vigilance. Articles of clothing and other materials subject to attack, should not be left undisturbed for long periods, particularly during the summer months, in such places as cupboards, attics, trunks, etc., unless adequate precautions have been taken to protect them from moth injury. Such articles, after being thoroughly brushed and beaten, preferably in strong sunlight, should be placed in well-made trunks or chests with tightly fitting lids, or enclosed in cotton or paper bags, or in cardboard boxes sealed with paper strips. Wrapping clothing in two thicknesses of strong wrapping paper, taking care to see that the edges are turned so that no moths may gain entrance is also recommended as an alternative measure. One pound of fresh naphthalene flakes or a similar quantity of paradichlorobenzene scattered among the garments in an ordinary sized trunk assures perfect protection from moth injury. When using cotton or paper moth-bags, one-half pound of either of the chemicals may be enclosed in each bag as an additional precaution.

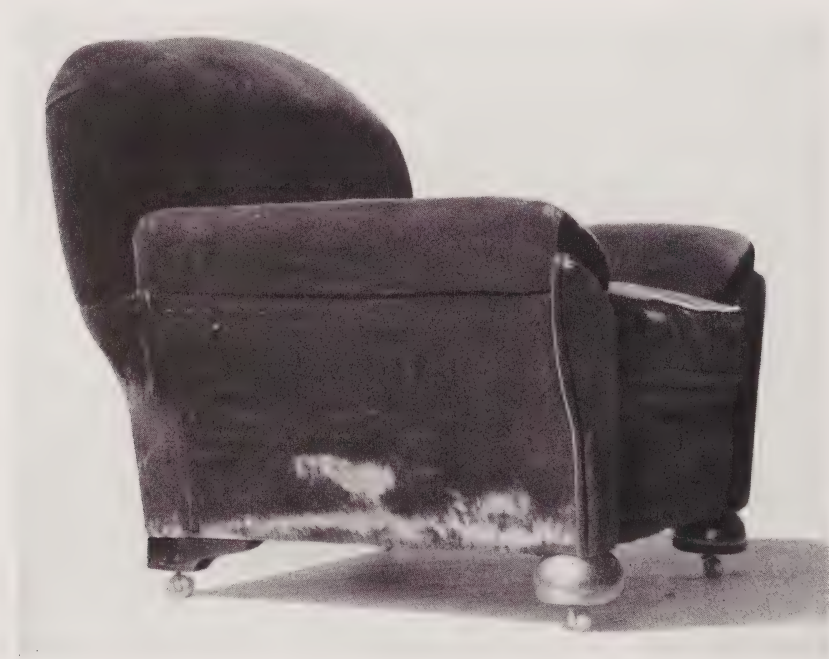


Fig. 36—Mohair covering of chair injured by webbing clothes moth (authors' illustration).

Clothing that is not protected in the above manner should be examined and carefully brushed at frequent intervals during the warm months of the year, or, if valuable, should be placed in cold storage. Articles of clothing already infested with moths may be freed of the insects by placing them in a tight trunk and fumigating with carbon bisulphide preferably at a temperature of not less than 70° F. This is done by placing a saucer on top of the clothing, pouring into it about three fluid ounces of carbon bisulphide, closing the lid tightly and allowing it to remain closed for from 24 to 48 hours. Carbon bisulphide vaporizes into a poisonous, highly inflammable gas, heavier than air. Owing to its inflammable, and, under certain conditions, explosive properties, no fire of any kind should be brought near the trunk while the fumigation is in progress. This fumigant may be substituted by either carbon tetrachloride alone, or ethylene dichloride-carbon tetrachloride mixture (see p. 9), the gases from which are non-inflammable and comparatively harmless to humans.

When available, the latter is preferable as it is a very efficient fumigant. In fumigating trunks with it the same dosage as recommended for carbon bisulphide should be used. Carbon tetrachloride is a weak fumigant, and with this chemical the above dosage should be trebled.

Whenever clothes moths are seen flying in the house it is important to take prompt measures to discover and remove the source of the infestation before it has a chance of spreading. Often the moths will be found issuing from neglected trunks or forgotten pieces of clothing in attics, basements, closets, etc. Sometimes the infestation will be found in upholstered furniture (fig. 36), and occasionally in collections of lint in floor cracks and behind baseboards. Infestations also occur in woollen lint, dust and debris that collects in the horizontal portions of the air shafts connected with hot-air furnaces in houses. These should be cleaned out periodically, or where infested portions are inaccessible a liberal application of a pyrethrum insect spray is recommended.

The frequent use of a vacuum cleaner on carpets and upholstered furniture and other articles subject to moth injury has a definite control value. When carpets or rugs are suspected of being infested they should be thoroughly cleaned on both sides with the vacuum cleaner. The vacuum cleaner and its attachments also may be used for removing the lint from such places as floor cracks, behind baseboards, and the air shafts of central heating equipment.

Moth damage to piano felting may be guarded against by placing about one pound of naphthalene flakes or paradichlorobenzene in open receptacles or suspended cheesecloth bags inside the piano and keeping it closed when not in use. The occasional use of a vacuum cleaner on the felting further reduces the risk of damage. When the house is to be closed for a time, which often happens during the summer months, it is a wise precaution to scatter naphthalene flakes liberally over rugs and carpets, afterwards rolling them tightly and tying them up in stout brown paper. Under such conditions upholstered furniture, unless guaranteed against moth injury, may also be treated with naphthalene, and well and tightly covered with paper or cotton sheets to lessen the risk of injury.

When upholstered furniture becomes infested with moths it is often difficult to eradicate them. There are three good methods, however, which have given excellent results and which may be used under different circumstances. (1) When the outside temperature is below zero the exposure of infested furniture or other articles, on a verandah or other convenient place, for a period of several hours will result in the destruction of all stages of the insects present. (2) When it is not possible to take advantage of low temperatures, heat may be used (see p. 12). This consists of exposing the furniture to a temperature of 130-140° F. for a period of not less than six hours. (3) The third method consists of fumigating with one of the following fumigants: carbon bisulphide, carbon tetrachloride, ethylene dichloride-carbon tetrachloride (see p. 9), or hydrocyanic acid gas (see p. 6). This last method is best carried out in a properly constructed fumigation chamber by an experienced fumigator. Other less satisfactory measures consist of removing the covering of the furniture and destroying all moths and larvae found, and liberally soaking infested areas with gasoline, observing precautions against fire risk.

When entire buildings are badly infested with clothes moths, superheating (see p. 12) or fumigation with hydrocyanic acid gas (see p. 6) may be resorted to.

In recent years a number of mothproofing substances have been placed on the market. Certain of these are in use by manufacturers, dyers and dry-cleaners. Experiments conducted with mothproofing solutions by various investigators have shown that solutions containing sodium fluoride, sodium silico-fluoride (fluosilicate), or cinchona alkaloids (quinidine for instance) have definite value when properly applied, *i.e.*, by immersion, or by spraying the materials until saturated. The use of rotenone, too, has been developed in this connection.

Various types of moth sprays are sold commercially. Many of these are only effective on contact with the insects. The pyrethrum-kerosene spray described on page 11 may be used, but it should not be relied upon for permanent protection against moth damage.

CARPET BEETLES

Carpet beetles, as their name implies, are chiefly notorious on account of the injury they frequently do to carpets, but they also attack other materials of animal origin, and are often associated with clothes moths in their ravages to clothing and various household fabrics. There are two common species of carpet beetles in Canada, both immigrants from the Old World. These are the black carpet beetle, *Attagenus piceus* Ol., and the buffalo carpet beetle, *Anthrenus scrophulariae* L. A third species known as the varied carpet beetle, *Anthrenus verbasci* L., also occurs in Canada. Carpet beetles pass through four life-stages,

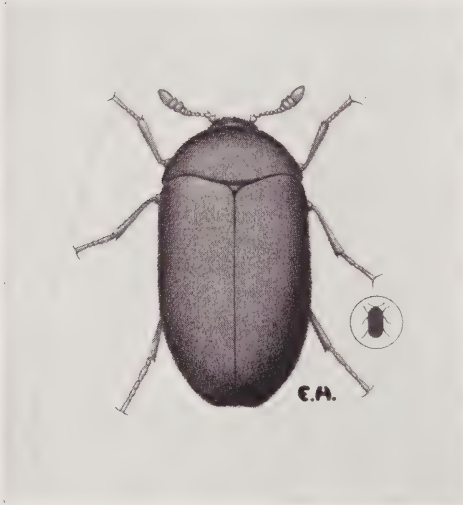


Fig. 37—The black carpet beetle, enlarged and natural size (authors' illustration).

viz., egg, larva, pupa and adult. The damage done by these insects is caused by the feeding activities of the larvae or grubs.

The black carpet beetle is widely distributed throughout the settled areas of the Dominion. The adults of this species (fig. 37) are small, oval, black beetles measuring about three-sixteenths of an inch in length. The beetles often may be seen in infested houses during the spring and summer months. Although harmless in themselves, they lay the eggs from which develop the injurious larvae. The larvae (fig. 38) are slender, reddish-brown grubs characterized by a tuft of long hairs at the

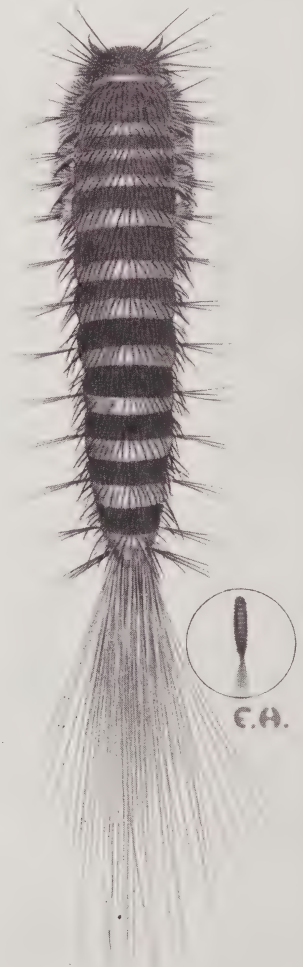


Fig. 38—Larva of the black carpet beetle, enlarged and natural size (authors' illustration).

end of the abdomen. When full-grown they reach a length of about three-eighths of an inch. They thrive best in a secluded environment where they are seldom disturbed, and are commonly found in floor cracks, under carpets, behind baseboards, in collections of dust and lint in the air shafts of central heating systems, and in neglected trunks, cupboards, etc. The larvae may be found in dwellings at any time of the year. The species passes the winter in the active larval stage, adults commencing to emerge (at Ottawa) in mid-March. Our observations indicate that there is only one generation a year.

The buffalo carpet beetle is also a widespread species in Canada. The adult beetle (fig. 39), is about



Fig. 39—The buffalo carpet beetle, enlarged and natural size (authors' illustration).

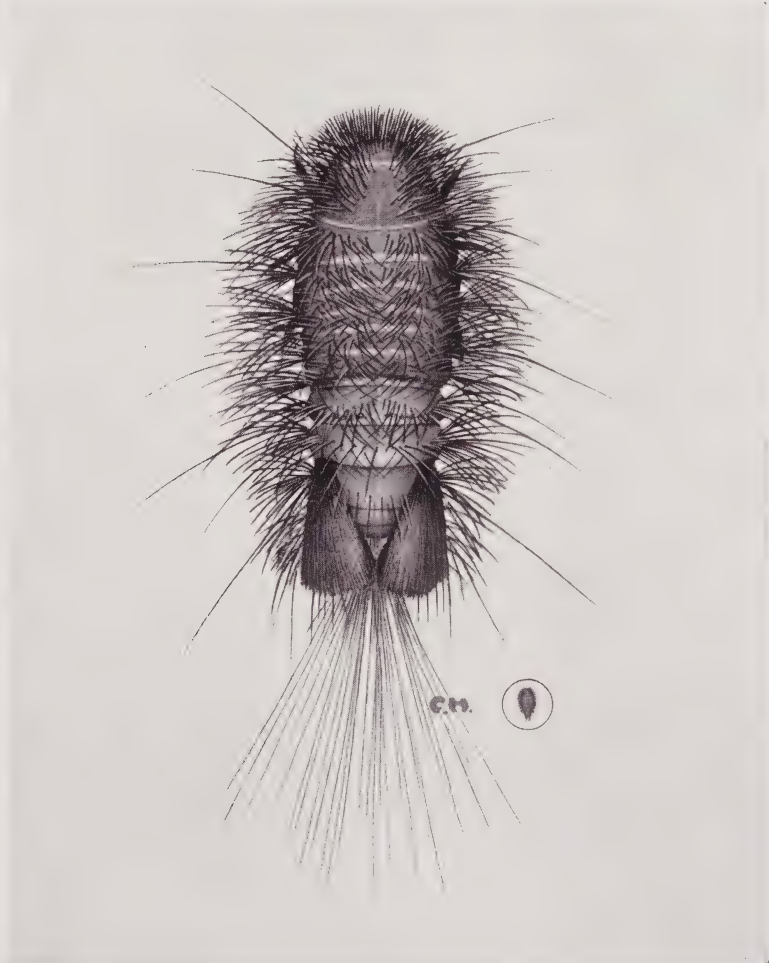


Fig. 40—Larva of the buffalo carpet beetle, enlarged and natural size (authors' illustration).

one-eighth of an inch long, broadly oval, and more brightly coloured than the black carpet beetle. The ground colour of the beetle is black, but down the middle of the back there extends a red stripe from which three projections merge into irregular bars of white scales. The beetles appear in early spring and summer and are strongly attracted by light, and for this reason are often found on windows. They have a fondness for the blossoms of certain flowering plants and have been taken frequently on flowers, particularly tulips, in gardens. Specimens kept in confinement at Ottawa in early spring lived for more than a month. They deposit their small pearly-white eggs in the nap or pile of the material on which the larvae later feed. Eggs deposited under observation hatched in eighteen days, but this period probably varies under different conditions of temperature and humidity. The larvae (fig. 40) are small, stout, brown grubs, copiously covered with long black hairs. As is the case with the larvae of the black carpet beetle they live for several months and are active all the year round in heated dwellings, feeding and shedding their skins as they grow.

Larvae of the varied carpet beetle are sometimes reported causing damage to woollen goods. We have reared the larvae of this species at Ottawa on dyed and undyed wool, and on a finely ground mixture of wheat, oats and other cereals which they appear to prefer. According to Back* the varied carpet beetle is a European pest well established in certain parts of the United States.

The larva (fig. 41) is a small, plump, brownish, hairy grub with a pale brown head, and three pairs of hair tufts at the end of the abdomen.



Fig. 41—Larva of the varied carpet beetle, much enlarged (after Back).

Control.—The practices recommended for the control of clothes moths are also effective in combating carpet beetles. Injury to clothing and other materials in trunks and boxes may be prevented by placing 1 lb. of good grade naphthalene flakes or paradichlorobenzene in each trunk. Where carpet beetle larvae are already present in rugs or clothing they may be destroyed by fumigating the infested articles in a tight trunk with carbon bisulphide or a similar fumigant as described on page 46 under clothes moth control. All cupboards, drawers, attics, etc., where injury is likely to occur should be periodically and thoroughly cleaned out. As the insects find an ideal hiding place in collections of dust and lint in floor cracks and similar situations, these should be either filled up with a patent crack filler and varnished over, frequently scrubbed out with soap and hot water, or treated with pyrethrum-kerosene spray. It is worth noting that houses with well-laid hardwood floors are seldom seriously troubled with carpet beetles. Furnace air shafts should also be cleaned out periodically.

Carpets and rugs should be raised at intervals and cleaned thoroughly on both sides, preferably with a vacuum cleaner, attention also being given to any cracks in the flooring beneath. A vacuum cleaner is also useful in removing collections of dust and lint from behind baseboards and other situations difficult of access, where the insects may breed. In cases of severe infestation recourse may be had to superheating (see p. 12) or fumigating with hydrocyanic acid gas (see p. 6). Pyrethrum-kerosene spray (see p. 11) will kill the various life-stages of the beetles on contact.

* U. S. F. B. No. 1346, 1923, p. 6.

CRICKETS

Crickets often enter dwellings and cause annoyance by their monotonous chirruping, particularly at night. The song of the cricket is produced by rubbing together the outer pair of wings which bear special structures for this purpose. Only the male crickets sing. Furthermore, crickets will feed on almost any organic substance, and, as a result, sometimes do considerable damage by feeding on woollen, silk and cotton clothing and other fabrics. Both the house cricket, *Gryllus domesticus* L., and the common black field cricket, *Gryllus assimilis* Fab., may cause damage of this nature.

The house cricket (fig. 42) originated in the Old World and has been established in Canada for many years (our records date from 1887). It is now widespread in Eastern Canada, and has been repeatedly reported infesting dwellings, particularly in Ontario and Quebec. This species is pale brown in colour and measures about three-quarters of an inch in length. It is very

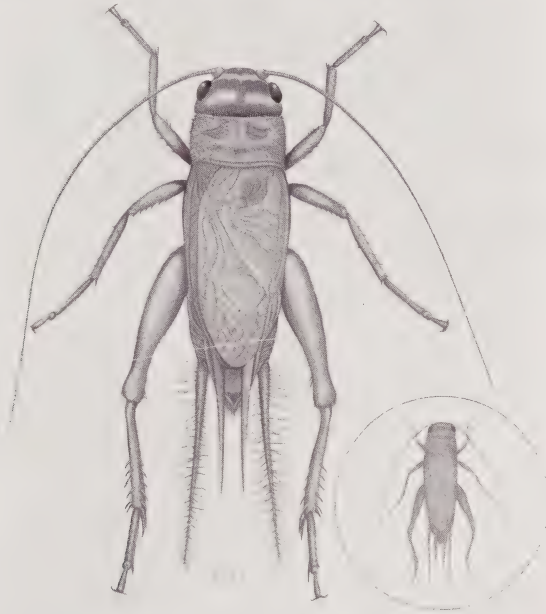


Fig. 42—The house cricket (male), enlarged and natural size (authors' illustration).

elusive, and often difficult to locate, a fact that further exasperates distressed householders. It favours warm situations, such as cracks and crevices in walls and brickwork close to fireplaces, chimneys and ovens, and for this reason often becomes troublesome in bakeries, kitchens and basements. During warm weather it lives readily outdoors and finds a favourite breeding place in collections of organic refuse such as garbage dumps. On the advent of cold weather it migrates to dwellings and under favourable conditions may remain active and continue breeding throughout the winter.

The common black field cricket (fig. 43) is widespread and abundant throughout Canada and occurs most commonly outdoors. It often finds its way into dwellings, particularly in the autumn, in search of warm protected places in which to hibernate. These crickets will eat practically anything when hungry and often attack clothing. When present in large numbers they have been known to do considerable damage in a single night.

Control.—Crickets may be prevented from breeding in such places as garbage dumps by incinerating all organic refuse as advocated for the control of the house fly. Where garbage dumps already have been established and are serving as breeding places for crickets, poisoned bait may be used under proper supervision by municipal authorities. This may be prepared by mixing together 1 lb. of Paris green (or white arsenic), 25 lb. of bran, 1 lb. of salt (not necessary in alkaline districts), 2 gallons of molasses, and water. The arsenical, bran, and salt should be mixed dry, after which the water and molasses may be added. Only sufficient water should be used to form a moist friable mash. The bait should be scattered thinly over the surface of the dump on a warm evening. Another formula used in the United States consists of 1 lb. of sodium fluosilicate, 20 lb. of bran, 2 quarts of molasses, and 1 gallon of water. In using these baits precautions should be taken to prevent the possible poisoning of cats and dogs.

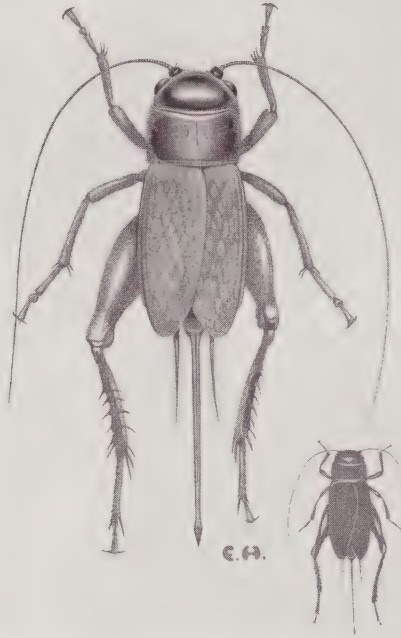


Fig. 43—The field cricket, *Gryllus assimilis* Fab. (female), enlarged and natural size (authors' illustration).

For the destruction of those crickets that have become established in dwellings, the use of fresh pyrethrum powder, or sodium fluoride is recommended. These materials should be blown liberally into the places wherein the crickets are hiding, by means of a dust gun or insecticide puffer, bearing in mind the fact that sodium fluoride is poisonous to humans and animals. Pyrethrum sprays (see p. 11) are also effective when in actual contact with the insects.

For other insects affecting upholstered furniture and household furnishings see under book lice (p. 54), cigarette beetle (p. 55) and powder post beetles (p. 56).

INSECTS AFFECTING TOBACCO, BOOKS, SEEDS, WOOD, ETC.

In this section an account is given of certain species of insects that attack a variety of materials in dwellings, such as papers and books, vegetable matter used as stuffing in mattresses and furniture, drugs, tobacco, seeds, floors, etc.

SILVERFISH

Silverfish, or fish moths as they are sometimes called, are slender, wingless, scale-covered insects possessing a pair of long antennae or "feelers," and three long tail-like appendages at the end of the abdomen (fig. 44). They are a widespread pest and frequently attract attention in dwellings, libraries, bakeshops and various other buildings especially in warm, moist, secluded situations where they occur on floors and walls and in and among papers, books, clothing, etc. When disturbed or suddenly exposed to strong light they run rapidly into a place of concealment. Silverfish feed chiefly on starchy materials and glue, and for this reason sometimes cause serious damage to glazed papers and the bindings of books. In addition, they attack starched clothing and fabrics, and feed on dry food-stuffs containing starch. They have been reported to remove the paste from behind wall-papers causing the latter to peel from the walls, and to otherwise damage the paper.

Two species of silverfish occur as household pests in Canada. These are scientifically known as *Lepisma saccharina* L., and *Thermobia domestica* Pack. The former species is a glistening silvery or silvery-gray insect, and the latter, which is the more common of the two, is pearly white mottled with dusky scales along the back.

Control.—Silverfish, like many other household pests, thrive best in situations left undisturbed for relatively long periods, such as among infrequently used books, and in basements, attics, etc. When their presence is discovered, the infested rooms should be subjected to a thorough house cleaning. This should be followed by dusting lightly or blowing fresh pyrethrum insect powder or sodium fluoride in the places where the insects are most numerous. Pyrethrum powder quickly loses its insecticidal properties and should be renewed at intervals until the insects have all disappeared. Sodium fluoride retains its killing power indefinitely, but should be used with caution owing to its poisonous properties. A mixture of these two materials is often used; also pyrethrum-kerosene spray



Fig. 44—A species of silverfish, *Thermobia domestica* Pack., enlarged and natural size (authors' illustration).

BOOK LICE

Book lice, or psocids, are tiny, pale, yellowish or grayish-white, wingless insects, measuring less than one-twelfth of an inch in length. They are louse-like in appearance, but their habits are quite unlike those of the true lice

which are parasites of warm-blooded animals and man. Book lice are so called because they frequently are found among the pages of old books that have lain undisturbed for some time. They feed on a variety of organic substances, but owing to their small size and feeble mouthparts are rarely considered injurious. Book lice sometimes occur in great numbers in dwellings, in summer and autumn, particularly in poorly lighted, warm, damp rooms which are seldom disturbed. In such places they may become a nuisance by swarming over floors, walls and furnishings. Occasionally they are found breeding in immense numbers in straw mattresses and in furniture stuffing of vegetable origin. A common species found in dwellings is *Atropos pulsatoria* L. (fig. 45). Specimens taken in houses at Kitchener, Ont., and at Hampstead, N.B., were *Troctes divinatorius* (Mull). Specimens from a house in St. Catharines, Ont., were *Lepinotus inquilinus* Heyden. The determinations were made by A. B. Gurney, at Washington, D.C.



Fig. 45—A common book louse, *Atropos pulsatoria* L., enlarged and natural size (authors' illustration).

Control.—Ordinarily book lice occur only in small numbers in dwellings, and under such conditions a thorough house cleaning combined with sunning and airing of the infested rooms and the objects therein, will give satisfactory results. When the book lice are present in large numbers, efforts should be made to find the source of the infestation which should be removed and, in the case of

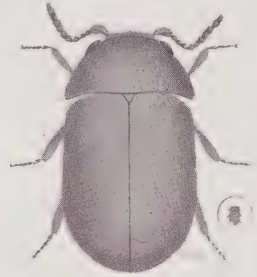


Fig. 46—Cigarettes damaged by the cigarette beetle (authors' illustration).

the straw stuffing of mattresses, burned. In addition to the above measures the liberal spraying of infested rooms with pyrethrum-kerosene spray (see p. 11) or dusting lightly with sodium fluoride (see p. 10) are also recommended. In badly infested premises where such measures are found insufficient the insects may be destroyed by superheating (see p. 12), or by fumigating with hydrocyanic acid gas (see p. 6).

THE CIGARETTE BEETLE, *Lasioderma serricorne* Fab.

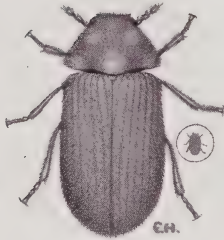
Although called the "cigarette" beetle and seemingly preferring tobacco (fig. 46) to other kinds of products, this insect does not by any means confine its attention to tobacco. It is known to feed, in addition, upon a number of different products kept in store, such as seeds, dried drugs, yeast cakes, etc., also on vegetable material used in upholstered furniture. The beetle, shown in figure 47, is brown in colour and, in length, is rather less than one-eighth of an inch. The grub is also small, whitish in colour and covered, noticeably, with numerous brownish hairs.



Control.—Tobacco or other material found to be infested, if in small quantities, should be destroyed by burning. We would welcome reports of serious outbreaks of this insect.

Fig. 47—The cigarette beetle, enlarged and natural size (authors' illustration).

THE DRUG STORE BEETLE, *Sitodrepa panicea* L.



This insect, shown in figure 48, sometimes occurs in dwellings and is not uncommon in drug stores, where it feeds upon various kinds of drugs (fig. 49), one writer recording that he found the insect on 45 different drugs. Herrick says that it makes no discrimination between those drugs "that are poisonous to human beings, at least, and those perfectly harmless. Indeed, in its drug menu are such bitter and poisonous substances as aconite and belladonna." In addition, it is known to bore into leather and books and, among household foods, to attack dried beans and peas, breakfast foods, flour, various syrups, etc. The beetle is about one-tenth of an inch long, reddish-brown in colour, and bears rather indistinct fine hairs. The grub is small and whitish in colour.

Fig. 48—The drug store beetle, enlarged and natural size (authors' illustration).

Control.—Same as for the cigarette beetle (see above).

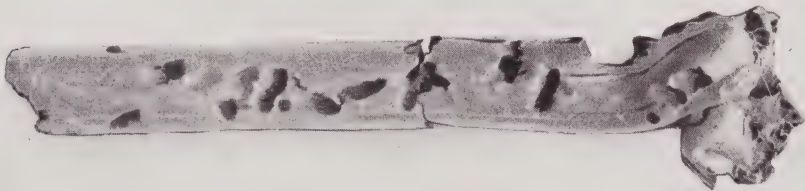


Fig. 49—Licorice destroyed by the drug store beetle (authors' illustration).

POWDER POST BEETLES

Complaints are not infrequently received of injury by these insects to wood products such as flooring, furniture, axe handles, etc. Hickory, ash and oak are especially subject to injury; other hardwoods, such as elm, maple, walnut, cherry and poplar are affected to a lesser degree. Only the sapwood is subject to injury. Softwoods, such as pine, spruce and fir, are never attacked by powder post beetles.

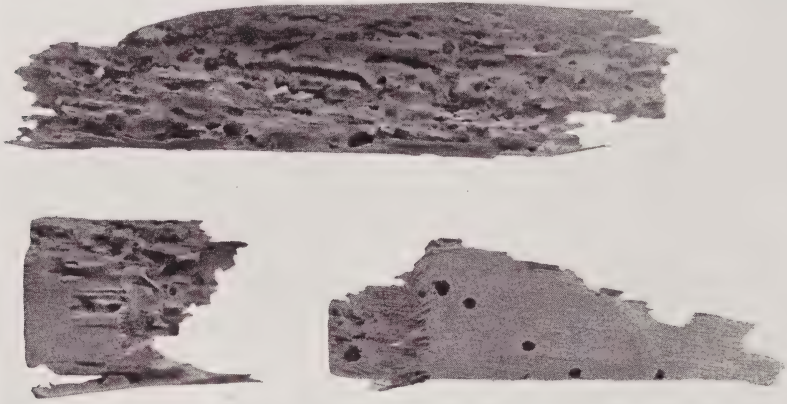


Fig. 50—Woodwork destroyed by powder post beetles (authors' illustration).

The presence of these insects is disclosed by fine boring-dust emitted from small holes on the wood surface and shaken from them when the wood is jarred. When split the wood is found to be perforated by long tunnels (fig. 50) filled with powder and extending in all directions. If the work is continuing the whitish grubs may be found in the ends of the tunnels.



Fig. 51—A powder post beetle, *Lyctus planicollis* Lec., enlarged and natural size (authors' illustration).

The adult insects are somewhat flattened, brownish beetles, about one-fifth of an inch in length. The grubs burrow through the wood in all directions leaving the tunnels behind them packed with powder. When full-grown, they are yellowish-white, one-eighth to one-fifth of an inch long. These insects may continue breeding generation after generation, ultimately seriously weakening or even completely ruining the wood in which they are working.

Several species of powder post beetles occur in Canada. The one shown in figure 51, namely, *Lyctus planicollis* Lec., is a widely distributed species; another species is *Lyctus striatus* Melsh.

Two other small beetles which bore in wood in houses are known, respectively, as *Anobium punctatum* DeG. and *Xestobium rufovillosum* DeG. We have only one record of the former species occur-

ring in houses, namely, in Nova Scotia. The latter species has been found in the province of Quebec. Regarding these two species, Imms,* quoting from Gahan, states: "The name of 'death watch' is often applied to both these species but belongs more properly to the latter insect. The tapping noise is a sexual call and is heard most often in April to May when pairing takes place. The beetle jerks its body forward several times in rapid succession each time striking the lower part of the front of the head against the surface upon which it is standing."

Control.—Flooring, furniture, or other wood products found infested may be treated with ordinary kerosene or pyrethrum-kerosene spray, rubbing it well into the small holes or forcing it in by means of a small atomizer or other force pump. A preparation recommended by the late Professor Lefroy consists of a mixture of orthodichlorobenzene, 91 per cent; white castile soap, 7 per cent; and cedar wood oil, 2 per cent. This may be brushed or sprayed on infested woodwork or applied as indicated above. Badly infested woodwork should be removed and destroyed by burning. Uninfested wood may be permanently protected from attack by one or more coats of shellac, varnish or paint.

THE BLACK CARPENTER ANT, *Camponotus pennsylvanicus* DeG.

Complaints received regarding this ant, so far as houses are concerned, have referred chiefly to injury to verandah posts. It is also known to effect important damage to rafters and beams, and to infest kitchens and pantries in search of sweets (see p. 31). The illustration herewith shows the work of this ant (fig. 52). As its common name indicates, the ant is a black species with a body length of three-eighths of an inch (fig. 15).

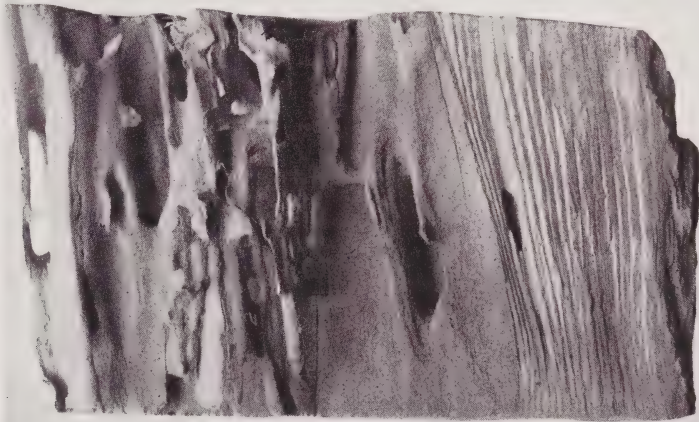


Fig. 52—The work of the black carpenter ant in wood (authors' illustration).

Control.—Outbreaks of this ant in verandah posts have been controlled simply by forcing hot water into the places where it had become established. Sodium fluoride has been used with success, puffing the powder into the places where the ants are working, repeating the application once a week until the ants have disappeared.

TERMITES

Termites, or so-called "white ants", are not, as yet, a pest of importance in Canada, but certain species have been found in a few localities. In 1931, W. J.

* A General Textbook of Entomology, 1925.

Brown, of the Division of Entomology, collected specimens of *Reticulitermes flavipes* Koll. in dried cow manure, at Point Pelee, Ontario. Prof. G. J. Spencer, of the University of British Columbia, in 1936 recorded three species in British Columbia, namely, *R. hesperus* Banks, *Zootermopsis angusticollis* Hagen, and *Z. nevadensis* Banks. He also reported several instances of damage by *Z. angusticollis* Hagen to timbers in buildings in the Vancouver area. In view of these occurrences, and the possibility of termites becoming established and causing damage elsewhere in Canada, it has been considered advisable to include a reference to them in this publication.

Termites (fig. 53) are superficially ant-like in appearance and, like ants, are social in habit and live in colonies made up of different castes. Actually, however, they are more nearly related to cockroaches than to ants, and can readily be distinguished from the latter by the pale colour of the majority, their soft and delicate integument, and by the fact that the abdomen is broadly joined to the thorax, instead of by a slender stalk.



Fig. 53—Termites, *Reticulitermes flavipes* Koll.; winged adults above, mature workers below, about four times natural size (original).

The food of termites is composed entirely of cellulose, which they obtain principally from dead or decaying wood. Their natural habitat is in the forest, but with the removal of the forest growth in infested regions, they have become increasingly destructive to the woodwork and contents of buildings, and to wooden objects in contact with the ground, such as fence posts, telephone poles, etc. As they are not yet an economic problem in Canada, their control has not been studied in this country. In the United States and other countries where they are a pest, control and prevention of damage is attempted by various methods such as, locating and destroying the colonies, treating wood with chemical preservatives, improved building construction, etc.

THE WHARF BORER, *Nacerdes melanura* L.

In recent years we have received a number of complaints, with specimens, of annoyance caused by the presence of this species of beetle in dwellings, garages, gasoline service stations, and public buildings. The larvae are reported to develop in moist or decaying wood, and to have caused serious damage to piling in the harbour of Saint John, N.B. Our records show that the insect has been taken in certain localities in the provinces of Nova Scotia, New Brunswick, Quebec, Ontario and Manitoba. The adult beetle is a slender, elongate insect, one-third to one-half an inch in length, and in colour dull-yellowish above, with the elytra or wing covers tipped with blackish-purple, the abdomen black.

Control.—Remove and destroy decaying wood. As a preventive measure in damp situations where decay is apt to develop use lumber thoroughly impregnated with creosote. The liberal use of a pyrethrum-kerosene spray (see p. 11) should effect the destruction of the adult beetles.

INSECTS AFFECTING HOUSE PLANTS

In this section mention is made of the more common species of insects found on house plants, together with control measures which have given good results.

APHIDS OR PLANT LICE

House plants of various kinds—rose, chrysanthemum, cineraria, geranium, etc.—are frequently attacked by small, soft-bodied insects known as aphids, or plant lice (fig. 54). There are several different species which are found in houses. Most of them are similar in appearance and greenish in colour, hence the common name “green fly.”

Aphids have sucking mouthparts, conspicuous antennae (feelers) and long legs. They feed on the tender growth of plants and by withdrawing the juices cause a distortion of the foliage and young shoots and, in extreme cases, partially or wholly destroy the plants. Their presence is frequently indicated by a curled distorted condition of the leaves. They may also infest and seriously injure the flowers.



Fig. 54—1, Aphids on snapdragon; 2, aphid parasitized by *Aphidius* sp.; 3, wingless aphid; 4, winged aphid; figures 2, 3 and 4 much enlarged (after Gibson and Ross).

Control.—Aphids may be controlled by spraying the infested parts of the plants with nicotine sulphate (40%). One teaspoonful will make one gallon of mixture. To this should be added one ounce of soap, dissolved in warm water.

Dr. Grace H. Griswold* says that the simplest way to control aphids on house plants is by the use of a 2 per cent free-nicotine dust (see p. 12). The effect on the aphids is almost instantaneous. The percentage of control depends largely upon the care with which the dust is applied. If plants to be treated are covered with a cloth, the dust will be confined and prevented from settling about the room. Horticultural sprays containing pyrethrum or derris extracts are also effective.

* Bull. 162, Cornell University, Dec., 1927.

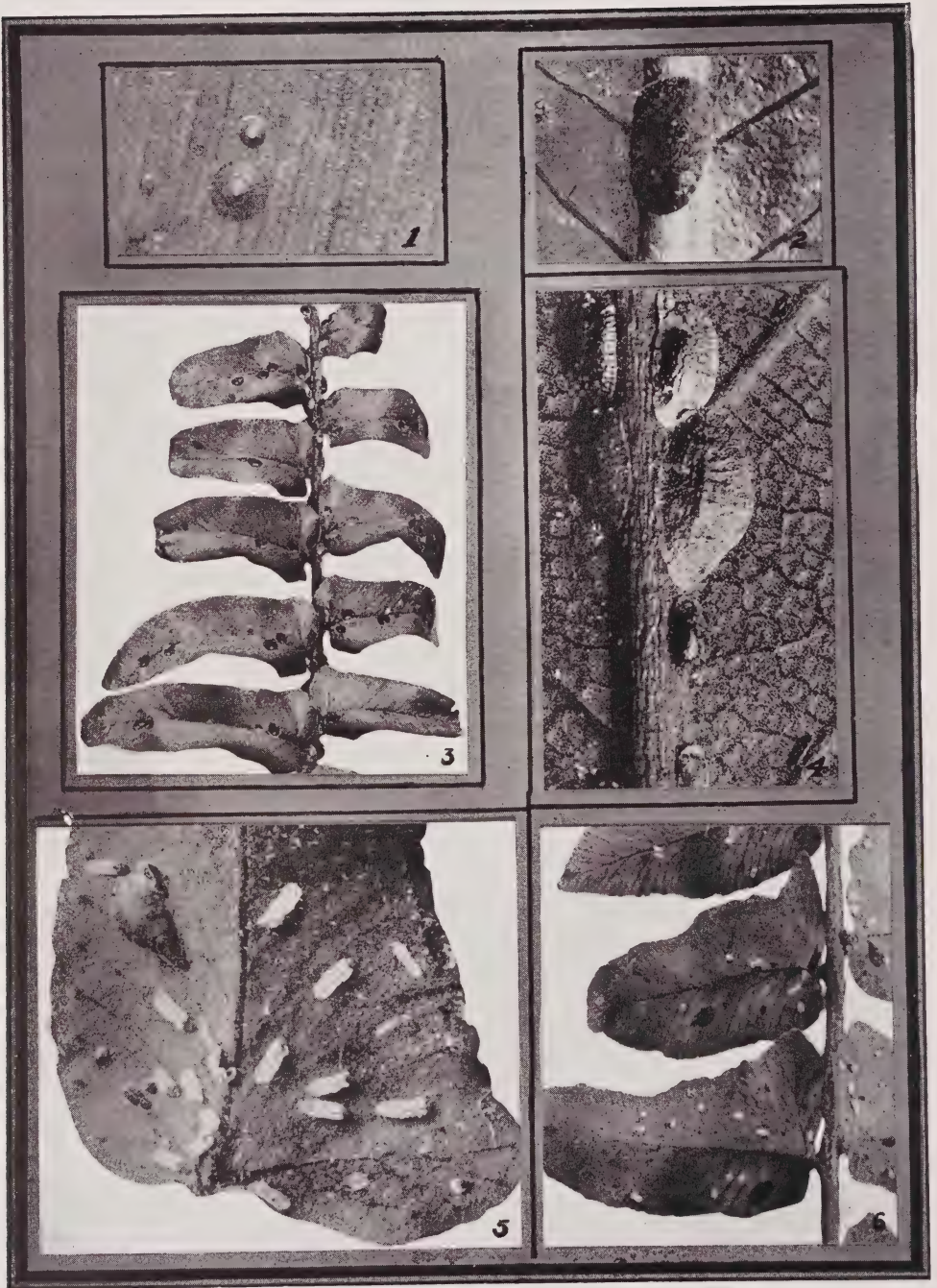


Fig. 55—Scale insects: 1, Florida red scale on palm leaf; 2, hemispherical scale on croton; 3, the same on Boston fern; 4, soft scale; 5, fern scale, males, females and young; 6, fern scale about natural size; figures 1, 2, 4 and 5 much enlarged (after Gibson and Ross).

SCALE INSECTS

Among the sucking insects which commonly infest house plants, are several species of scale insects (fig. 55), known respectively as the soft scale, *Coccus hesperidum* L., a soft, oval, slightly convex, brownish species about one-eighth of an inch in length; the hemispherical scale, *Saissetia hemisphaerica* Targ., in general similar to the soft scale; the oleander scale, *Aspidiotus hederae* Vall., circular, nearly flat, about one-sixteenth of an inch in diameter and, in colour, whitish or light gray; the Florida red scale, *Chrysomphalus aonidum* L., similar in general to the oleander scale, but dark purplish-brown in colour, with a nearly central, nipple-like prominence; and the fern scale, *Hemichionaspis aspidistrae* Sign., the male of which is white, with three distinct elevations or ridges, and roughly rectangular in shape, the female being pale brown, inconspicuous and somewhat pear-shaped.

Scale insects are found on various kinds of house plants, more frequently, however, on such plants as fern, palm, oleander and ivy.

With the exception of the soft scale, the above-mentioned scale insects reproduce by means of eggs which are deposited beneath the scale. The female of the soft scale on the other hand gives birth to living young. The newly hatched or newly born larvae, as the case may be, crawl around for a short time, then settle down on the leaves or stem, insert their sucking mouthparts and feed on the juices. They cover themselves with a waxy material which forms the scale or covering. The females remain stationary throughout their lives. The males, on the other hand, when they become mature, acquire wings, emerge from their scale coverings and fly around and fertilize the females.

Control.—Scale insects may be kept under control by sponging or spraying the plants with common laundry soap, a quarter of a pound to each gallon of water, or with nicotine sulphate (40%) using about $1\frac{1}{4}$ teaspoonfuls to a gallon of water to which about 1 ounce of soap has been added. It is advisable, especially in the case of ferns, to wash off the spray material about two hours after it is applied. In houses where only a few plants such as oleanders or strong-leaved ferns are infested, they may be washed with such a soap mixture by means of a soft brush or cloth, or the plants may be inverted and the stems and leaves thoroughly doused in a pail containing the soapy mixture. If a piece of cloth is held tightly around the base of the plant, the earth in the pot will be prevented from falling into the pail. Two or three applications a week apart may be necessary.

As scale insects flourish to best advantage in a dry atmosphere, palms, rubber plants, ferns and crotons, should be frequently syringed with water and should be kept under humid conditions. It has been observed in the case of the fern scale, that this insect is of no importance in humid fern houses, and only becomes troublesome on plants kept in a dry atmosphere, such as one finds in houses, stores and halls.

MEALY-BUGS

Mealy-bugs (fig. 56) are closely related to the scale insects and may be found on house plants in any season of the year. Coleus, rose, fuchsia, geranium, palm, oleander, orchid and



Fig. 56—Mealy-bugs; egg masses and nymphs on bougainvillea (after Gibson and Ross).

other plants are attacked. Two species commonly occur in houses—the common mealy-bug, *Pseudococcus citri* Risso, and the long-tailed mealy bug, *P. longispinus* Targ. The former has very short caudal or “tail” filaments, whereas the latter, as its name indicates, has long filaments—frequently longer than the insect’s body.

The bugs occur in masses on the tender shoots and on the under and upper sides of the leaves and on the petioles. Individuals of all sizes may be found on the plants at the same time, especially on the undersides of the leaves along the mid-ribs and near the base of the leaf stems. They injure the plants by extracting the sap, in extreme cases causing the foliage to turn yellow and drop prematurely. Infested plants are also rendered unsightly by the disgusting masses of insects, and by the presence of a sooty fungus which grows in a sweet, sticky liquid called honey dew which is excreted by the bugs.

Control.—The cheapest, safest, and simplest method of combating mealy-bugs is to spray the insects off forcibly with water. Each plant should be treated individually and, if growing in a pot, should be rotated by hand, while the water is being applied under high pressure. Sponging or brushing with a nicotine-soap solution (see p. 61) may be resorted to when forcible sprinkling is impracticable.

THE GREENHOUSE WHITEFLY, *Trialeurodes vaporariorum* Westw.

Several different kinds of house plants are attacked by this small insect (fig. 57). Primulas, especially, are commonly infested. The adult insect is a small four-winged moth-like creature about one-sixteenth of an inch long, the wings being pure white in colour and the body yellowish. The nymph is flat in shape, oval in outline, and pale greenish in colour. They are sucking insects, feeding greedily from the undersides of the leaves upon the plant juices. Severely attacked leaves dry up and die.



Fig. 57—Greenhouse whitefly; adults and nymphs, enlarged four times (after Gibson and Ross).

Control.—Spray the undersides of leaves of the infested plants with a mixture of ivory soap and water, $\frac{1}{2}$ lb. of the former dissolved in 3 gallons of the latter, or with linseed oil soap, 1-200, or with a suitable commercial pyrethrum extract spray. A 2 per cent free-nicotine dust (see p. 12) has been found effective in controlling plant lice on house plants and would doubtless also control the whitefly.

FUNGUS GNAT MAGGOTS

Certain of the so-called fungus gnat maggots (Mycetophilidae) are known to feed upon the tender roots of household plants. The maggots are whitish in colour and, when full-grown, are about one-quarter of an inch in length. The small adult fly, about one-twelfth of an inch in length, which may frequently be observed near the plants, is two-winged, the body being dark brown or blackish in colour. Injury by these insects may be caused to geranium, begonia, fern, coleus, etc.

Control.—The treatment of soil infested with these maggots with strong soap suds has been found of value. Pots containing soil known to be infested may be placed in a large pail containing soap suds, so that the water will just reach the top of the soil. The pot should be left there for a few hours and drained well afterwards. It may be necessary to repeat this treatment after an interval of a week or so.

INSECTS LIKELY TO BE PRESENT IN OR ON FRUITS AND VEGETABLES BROUGHT INTO THE HOME

In order that the housewife may be familiar with certain of the more common pests not infrequently found in or on fruits and vegetables sold in the trade, the following information is given.

THE CODLING MOTH, *Carpocapsa pomonella* L.

The small, whitish or pinkish, smooth, unmarked caterpillars of the codling moth are present in the fruit of many unsprayed apple orchards. This fruit, unfortunately, very often finds its way into the home and, when used for food, the caterpillar, which may attain a length of three-quarters of an inch, is exposed. Figure 58 shows the work of this insect. Many housewives undoubtedly would discard such infested apples. This, however, is not always necessary as usually only a part of the apple is injured, the remaining portion, of course, being perfectly edible.



Fig. 58—Codling moth caterpillar and its destructive work in apple (authors' illustration).

THE APPLE MAGGOT, *Rhagoletis pomonella* Walsh.

The apple maggot is a well-known pest of the apple in Eastern Canada. It is whitish in colour, difficult to see, and when mature is about one-quarter of an inch in length. It burrows in all directions through the flesh of the apple, feeding upon the pulp and leaving discoloured channels, as shown in figure 59. Not infrequently, infested apples which show no external sign of injury, are brought into the home, but, as a rule, fruit from orchards in which the insect is causing appreciable damage, is misshapen and appears much like that shown in the illustration. The use of apples infested with apple maggot is, of course, not recommended.



Fig. 59—Malformed apple and tunnelling in apple—work of the apple maggot (authors' illustration).

THE PLUM CURCULIO, *Conotrachelus nemophar* Hbst.

This curculio is a snout beetle about one-fifth of an inch in length, in general appearance somewhat similar to the apple curculio (fig. 60), but with a much shorter and stouter snout. In the latter part of August and during the first half of September, the beetle feeds upon the nearly full-grown apples causing important injury. Unless the uninjured portions of such fruit are used at once, decay where the punctures have been made is very liable to develop.

THE APPLE CURCULIO, *Tachyterellus quadrigibbus* Say.

This snout beetle (fig. 60) is an important enemy of the apple in the province of Quebec. The beetle is reddish-brown in colour and about one-quarter of an inch in length. It punctures the fruit for the purposes of oviposition and feeding.

Mr. C. E. Petch, in charge of the Dominion Entomological laboratory, Hemmingford, Que., has given this insect special study. He says: *"The punctures arrest growth and result in hard, green, core-formations extending generally to the centre of the apple. These hardened portions are bitter and if the fruit is badly punctured, it becomes unfit for eating. Even when the apples are cooked, the little green cores remain as small lumps and materially lessen the quality of the product." In order that the housewife may be familiar with the work of this insect, injured apples are shown in figure 61.

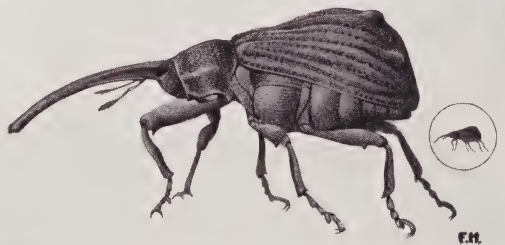


Fig. 60—The apple curculio, enlarged and natural size (after Petch).

* Circular No. 36, Dom. Dept. Agric.



Fig. 61—Apple curculio injury: (a) feeding punctures; (b) oviposition punctures (after Petch).

THE ORIENTAL FRUIT MOTH, *Laspeyresia molesta* Busck

This pest occurs only in peach-growing districts in the Province of Ontario. Peaches infested by the caterpillars may, some years, be purchased by housewives. The figure herewith illustrates the work of the insect (fig. 62). The caterpillar, when very young, is whitish in colour with a black head. Later it turns to a

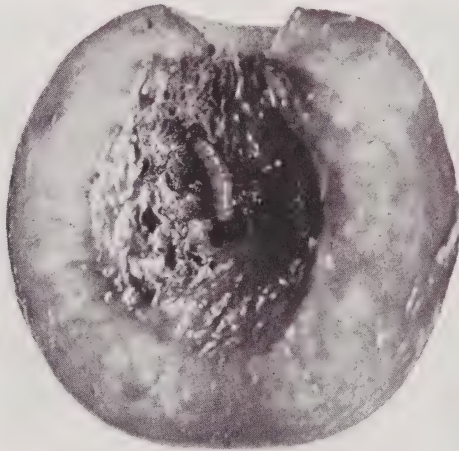


Fig. 62—Oriental fruit moth caterpillar and its work (authors' illustration).

pinkish or reddish colour. When it has reached full growth it is about half an inch in length and in general very similar to the caterpillar of the well-known codling moth. It feeds upon the pulp of the fruit. The infested fruit should be destroyed.

THE GRAPE BERRY MOTH, *Polychrosis viteana* Clem.

In grape-growing sections of the Niagara peninsula, Ont., this insect is sufficiently abundant some years to attract attention. The small dark greenish to purplish coloured caterpillars, which hatch from eggs laid on

the berries by the moths, bore into the fruit and feed upon the pulp. Unfortunately they may still be inside the berries when placed on the table. Frequently, however, their presence in a bunch of grapes may be observed by certain of the clusters being webbed together with silk spun by the small caterpillars. This is illustrated in the accompanying figure (fig. 63). When noticed the bunches should be examined carefully and berries with small holes in them, or which are partly decayed, should be destroyed.



Fig. 63—Grapes infested with larvae of the grape berry moth (authors' illustration).

CHERRY FRUIT FLIES, *Rhagoletis cingulata* Loew and *Rhagoletis fausta* O.S.

In the Province of Ontario, cherries bought on the market are, some years, infested by the maggots of one of the above-mentioned cherry fruit flies. The maggots are whitish or yellowish in colour and, when full-grown, about a quarter of an inch in length. They feed inside the fruit and, even when the latter is being picked, there may be no external evidence of infestation. As a consequence, the wormy cherries may be discovered only when the housewife is preserving them for winter use. Growers of cherries who know that these insects are present in their orchards should endeavour to control them and, furthermore, prevent the sale of wormy cherries.

SCALE INSECTS

Scale insects of several kinds are not infrequently found on fruit, particularly apple. Four species have been complained of; namely, the oyster shell scale, *Lepidosaphes ulmi* L.; the scurfy scale, *Chionaspis furfura* Fitch; the San José scale, *Aspidiotus perniciosus* Comst., and the European fruit scale, *Aspidiotus ostryae*.

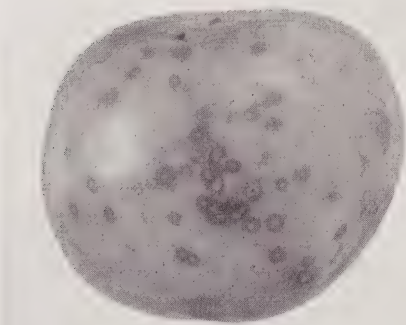


Fig. 64—Apple infested with San José scale (authors' illustration).

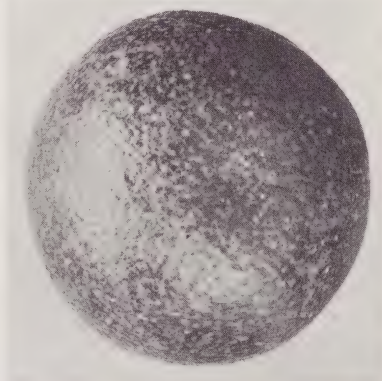


Fig. 65—Orange infested with the red scale (authors' illustration).

formis Curtis. The figure herewith shows discoloration to the skin of the apple as a result of the work of the San José scale (fig. 64). The pear is, also, similarly attacked.

Scale insects also may be found on the skin of oranges and lemons (fig. 65). The California red scale, *Chrysomphalus aurantii* Mask., is common on the former, and the oleander scale, *Aspidiotus hederae* Vall., on the latter.

It is seldom that scale insects are sufficiently numerous on fruit to render it unfit for use in the home. In the case of apples and pears, it is a wise procedure, whether the skin is infested or not, to peel the fruit before using it. This practice is followed with oranges. As regards lemons, these are washed before shipment to Canada is made. If, notwithstanding this, scale insects are present, an additional washing or wiping should remove them.

THE IMPORTED CABBAGE WORM, *Pieris rapae* L.

This pest, the caterpillar of the butterfly known as the white cabbage butterfly, feeds commonly on the heads of cabbages and also on the green portions of the heads of cauliflowers. The caterpillar, velvety green in colour, measures about an inch in length when mature, and may be readily seen. If not present, its work may be detected and also the frass or dirt it leaves behind. Many housewives follow the practice of soaking such vegetables in water in which salt has been dissolved. With this treatment any insects present should soon be noticed.

THE CABBAGE MAGGOT, *Hylemyia brassicae* Bouche



Fig. 66—Table turnips and radishes infested with cabbage maggot (after Gibson and Treherne).

The small whitish maggots of this insect commonly infest the roots of radishes and turnips, and infrequently the heads of cauliflowers. The presence of one or two maggots in radishes and small garden turnips should render them unfit for sale, but the infestation may not be detected by the grower and as a

consequence the vegetables are brought into the house. The figures herewith illustrate the work of the maggot (fig. 66). Infested radishes and cauliflowers should be destroyed. In the case of table turnips, it is often possible to cut away the injured parts and use the remainder of the roots.

THE DIAMOND-BACK MOTH, *Plutella maculipennis* Curt.

The small green caterpillars of this moth, which when mature are about three-eighths of an inch in length, commonly infest the leaves of cabbages. After completing their growth they spin open network cocoons on the lower sides of the leaves. In this way the insect is brought into the home and, in years of abundance, moths emerging from the cocoons on the leaves may be present in sufficient numbers to displease the housewife. The moth is slender in appearance and, in general colour, grayish or brownish. It has a wing expanse of about five-eighths of an inch. This insect does not cause any damage in the house but, on account of its size and general appearance, may be mistaken for those kinds which attack foodstuffs.

THE CARROT RUST FLY, *Psila rosae* Fab.

In Eastern Canada, this insect is an important enemy of carrots. The maggot is of a yellowish colour and when mature is about one-quarter of an inch in length. Very often the maggot will be found in carrots stored in sand for winter use (fig. 67). When prepared for the table, the infested parts may usually be removed and destroyed. If, however, the brownish tunnels of the maggot are seen to be numerous, the carrots should, of course, be destroyed. The sand in which they have been stored should be carefully removed in spring and buried in a deep hole or thrown into water, as it will doubtless contain many of the insects which have entered it to pupate.



Fig. 67—Portion of carrot showing the work of the larvae of the carrot rust fly (authors' illustration).

THE PEA MOTH, *Laspeyresia nigricana* Steph.

In Eastern Canada, the small whitish caterpillars of the pea moth, which, when mature, are about half an inch in length, are frequently found in the pods of garden peas when being shelled. The caterpillars feed upon the forming peas, eating into them and thus causing irregular cavities (fig. 68). All such infested material should be destroyed. In badly infested gardens it would be advisable to remove all the vines and burn them before the insects leave the pods.

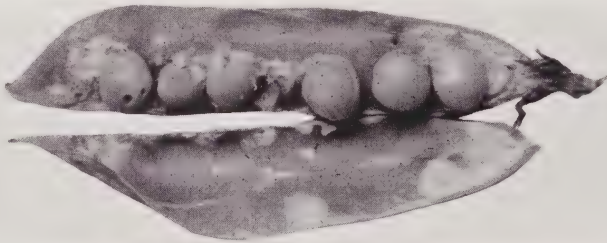


Fig. 68—Pea moth injury to garden peas (original).

THE PEA WEEVIL, *Mylabris pisorum* L.

Garden peas harvested for winter use may some years be found to be infested (fig. 70) with the well-known pea weevil (fig. 69), often referred to as the "pea bug". The grub feeds on the forming peas in the pod and, when mature, changes

there to the adult beetle, a small brownish-gray species about one-fifth of an inch long. When garden peas are known to be infested they should not be allowed to ripen, but the vines should be carefully gathered and piled so that the unused pods containing the insects may be burned.

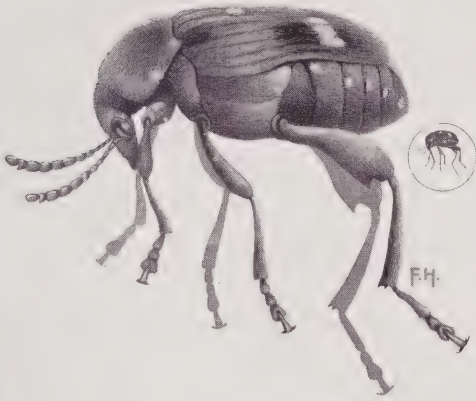


Fig. 69—The pea weevil, enlarged and natural size (authors' illustration).



Fig. 70—Peas infested with pea weevils (authors' illustration).

THE EUROPEAN CORN BORER, *Pyrausta nubilalis* Hbn.

This caterpillar or borer, present only in Eastern Canada, has a special fondness for sweet corn such as bantam. In certain sections, particularly of Ontario, ears brought into the home have been found to be infested with the borer (fig. 71) which not only feeds upon the kernels, but also burrows into the

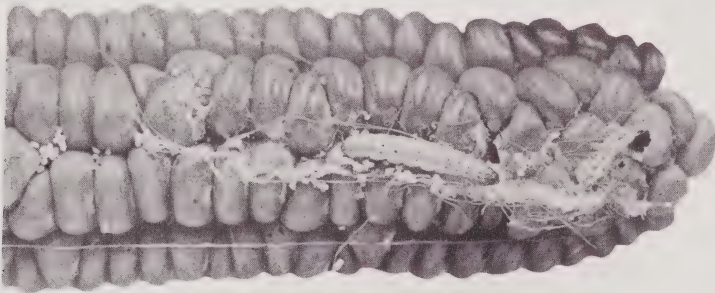


Fig. 71—European corn borer attacking ear of corn (authors' illustration).

cob. The borer when mature is about one inch long, of a light brownish or flesh colour with a dark brown head. As this is a very serious pest of corn and certain other plants, all caterpillars found should be destroyed. Infested cobs should not be thrown outside, but should be burned or immersed for several minutes in boiling water.

THE CORN EARWORM, *Heliothis obsoleta* Fab.

This caterpillar when mature is from about one and one-quarter to one and one-half inches in length. It varies in colour from light green to dark brown, with rather indistinct stripes on the back, and a wider, conspicuous, pale coloured

band along the side. It attacks the ears of garden or sweet corn, feeding on the kernels, particularly those near the tassel. Some years the insect is quite abundant and at such times it may also be found boring in the fruit of tomatoes. It is occasionally found in tomatoes imported into Canada from southern regions (fig. 72).

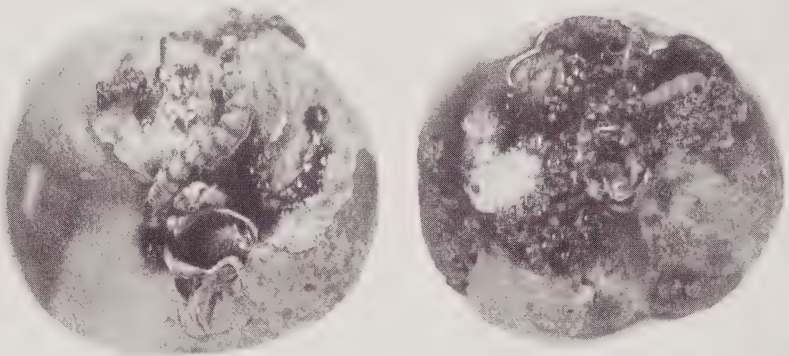


Fig. 72—Greenhouse tomatoes destroyed by corn ear worm: caterpillar feeding on tomato at left (after Gibson and Ross).

THE SPINACH LEAF MINER, *Pegomyia hyoscyami* Panz.

Beet greens are very popular and preferred by many to spinach. The foliage, however, of both plants in some years is noticeably attacked by the spinach leaf miner, the injury showing as conspicuous discoloured blotches (fig. 73).



Fig. 73—Beet leaves infested with spinach leaf miner (authors' illustration).

The maggot which mines in the leaves, causing this injury, is white in colour and rather small in size. If an infested leaf is held up to the light, the maggot, as a rule, may be seen in its mine. All infested portions of leaves used as greens should be removed and destroyed.

WIREWORMS

The slender, hard-shelled, yellowish or reddish-brown larvae, about an inch or less in length, commonly known as wireworms (fig. 74), occasionally may be found in the tubers of potatoes in autumn. Wireworms feed normally

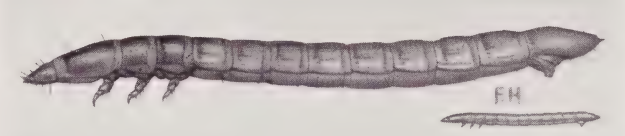


Fig. 74—A wireworm, enlarged and natural size (authors' illustration).

on the roots of grasses and occur commonly in land which has been in sod for several years. When such infested land is used for a crop like potatoes, the wireworms attack the latter causing injury similar to that shown (fig. 75). During the winter months, when potatoes are being prepared for the table, hardened, dark-coloured, channel-like areas may be found. These result from wireworm attack. Such sections, of course, should be removed.

SLUGS

These soft-bodied creatures which are molluscs commonly infest well-matured tomatoes. They eat out conspicuous cavities, the injury often not being noticed until the tomatoes are brought into the home. They also attack the tubers of potatoes (fig. 76), as well as the roots of radishes and carrots. Slugs are nocturnal in habit, hiding during the day beneath stones, clods of earth, etc. Uninjured portions of tomatoes or other vegetables should not be destroyed. The slugs affect only the parts where they have been feeding.

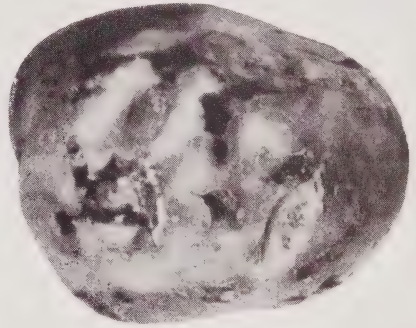


Fig. 75—Potato damaged by wireworms (authors' illustration).

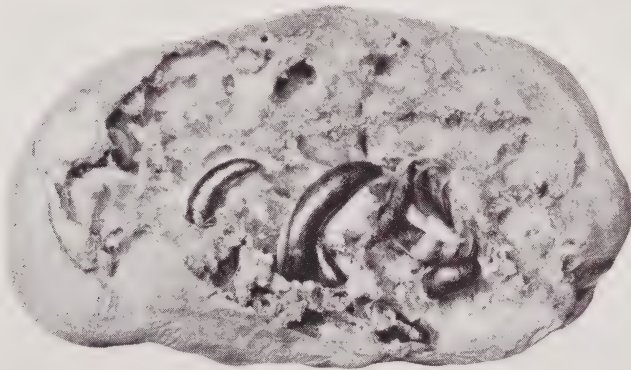


Fig. 76—Slugs feeding on potato (authors' illustration).

APHIDS OR PLANT LICE

Lettuce grown in greenhouses for winter use is subject to attack by aphids of the genera *Myzus* and *Macrosiphum*. These insects, generally referred to as "green fly", feed on the juices of the plants through their beak-like sucking mouthparts. Plant lice are so small that they may be easily overlooked by the housewife. While we do not wish to infer that all lettuce grown for winter use is infested by aphids, we do advise forceful washing of the leaves to dislodge any specimens that may be present.

OTHER FRUIT OR VEGETABLE INFESTING INSECTS

There are a number of other kinds of insects or their injury which the housewife may observe from time to time—for instance, the apple fruit miner, the lesser apple worm, the dock false worm (fig. 77), the apple red bug, the apple seed chalcid, the gooseberry fruit worm, the currant fruit fly, the rhubarb curculio, budmoth, etc.—but most of these are usually of limited occurrence and it is therefore not necessary to draw special attention to them here.



Fig. 77—Larvae of dock sawfly and injury caused by its habit of boring into apples, in autumn, to hibernate (after Gibson).

OTHER INSECTS THAT ENTER DWELLINGS AND ARE OBNOXIOUS BY THEIR PRESENCE

In addition to the insects mentioned in the foregoing chapters, there are a number of other kinds which at times enter houses and, by their presence, may become a nuisance.

THE CLUSTER FLY, *Pollenia rudis* Fab.

As the common name indicates, this fly (fig. 78) is well known from its habit of gathering or clustering in numbers in houses, being observed particularly in autumn. At such time it is frequently a decided nuisance. During the summer months the cluster fly lives out-of-doors, but in the autumn it frequently enters dwellings to hibernate for the winter. It gains entrance through places often overlooked by householders: around window frames, under shingles, through cracks in foundations, and similar locations.

This fly is sluggish in habit. In appearance it is somewhat larger and generally darker in colour than the common house fly and, unlike this latter insect, bears on its body many short yellowish-coloured hairs. The larvae or maggots of this species develop as internal parasites of earthworms.

Control.—A simple method of destroying these flies is to spray them with the pyrethrum-kerosene mixture described on page 11. All dead flies, as well as those which may be only stupefied, should be swept up and burned. Openings such as loose window frames through which they may gain entrance should be checked over in the autumn if these flies are troublesome.



Fig. 78—The cluster fly, enlarged and natural size (original).

MIDGES AND OTHER FLIES

There are several kinds of flies, such as midges, crane flies and others, not dealt with in the foregoing pages of this bulletin, which gain access to houses, particularly during warm summer evenings. In the main these insects are not injurious, but on occasions they cause annoyance by flying around lighted lamps, particularly those near a reading table or resting couch.

On several occasions we have received reports, with specimens, of the presence of small flies of the species *Chloropisca variceps* Lw. in dwellings. One correspondent found them in winter in great numbers between a sash and wall evidently hibernating. Another correspondent reported them as troublesome in spring and autumn about the front porch and on ceilings indoors. Specimens of this species which is related to the well-known wheat stem maggot, *Meromyza americana* Fitch, have been received from Ontario, Manitoba, and Alberta, indicating a widespread distribution.

Control.—Many of the larger flies may be kept out of the house by proper screening, but the very small midges are able to get through the meshes of ordinary screens. If they become especially numerous, the fly spray described on page 11 should be used.

CUTWORM MOTHS

The moth of the W-marked cutworm, *Spaelotis clandestina* Harr., which is active in June, July, August and September, occurs from Nova Scotia to British Columbia. It expands about $1\frac{5}{8}$ inches when the wings are spread. The front wings are of a dark, smoky-brown colour and bear rather indistinct transverse lines and spots. The hind wings are whitish, tinged with brown, darkest at the outer edges. In years when the moths are abundant, they fly into houses during the evening and become quite a pest.

The yellow-headed cutworm moth, *Septis arctica* Bdv., is a fairly large species expanding, when the wings are spread, from $1\frac{3}{4}$ to slightly more than 2 inches. The front wings are reddish-brown, shaded towards the base and the



Fig. 79—A cutworm moth, enlarged and natural size (authors' illustration).

outer space with bluish-gray; transverse lines and spots are also present. The hind wings are brownish, the outer third being darkest. This moth is also widespread in distribution, being found from the Atlantic to the Pacific. When abundant, it has the annoying habit of flying into houses, getting into lamps, etc., and soiling curtains and clothes.

The army cutworm moth, *Chorizagrotis auxiliaris* Grt., is some years very abundant in the Prairie Provinces, particularly Alberta. With the wings spread, the average width is about $1\frac{1}{2}$ inches. In colour the moths may be of a reddish, brownish or grayish shade. The moths of this latter species gain admission into houses mainly under the shingles. In Entomological Branch Bulletin No. 13, it was recorded that in one house at Lethbridge, Alta., which had every door and window screened, our officers took as many as 700 moths at night from a light trap hung in the attic.

Control.—The proper screening of doors and windows will prevent many cutworm moths from entering dwellings and thus serves to reduce infestations.

THE BEET WEBWORM, *Loxostege sticticalis* L.

This common prairie pest is some years enormously abundant and, when an outbreak occurs, the caterpillars assume the marching habit and enter gardens and even houses, much to the annoyance of the occupants. In writing of an outbreak in Alberta, in 1919, Strickland* says: "On July 26, migrating swarms appeared in the city of Calgary and their numbers increased with such startling rapidity that the effect upon the citizens might almost be described as one of panic."

The beet webworm (fig. 80) when mature is about an inch in length, greenish in colour with yellow stripes on the back and sides. On reaching full growth, in years of such abundance, the marching habit is developed, usually lasting only for a few days, during which time the caterpillars enter the earth to make the cocoons in which they pass the winter.

Control.—When an outbreak of the caterpillars occurs, and they have assumed the marching habit, their entrance into gardens and houses may be prevented by digging a trench about 10 inches deep along the sides from which they are advancing, and placing in it a poisoned bait consisting of freshly pulled moistened weeds, such as lamb's quarters, pigweed, shepherd's purse, etc., which have been well dusted with Paris green, at the rate of 1 lb. of poison to 50 lb. of weeds. The poisoned bait should be renewed when necessary.



Fig. 80—Beet webworm larvae, natural size (after Gibson).

THE STRAWBERRY ROOT WEEVIL, *Brachyrhinus ovatus* L.



Fig. 81—The strawberry root weevil, greatly enlarged (after Downes).

This weevil is about one-quarter of an inch in length, blackish in colour, and in appearance as shown in figure 81. It is an important pest of strawberry plants, being particularly destructive in the Province of British Columbia. It also occurs in the eastern provinces. On several occasions we have received specimens with the complaint that the beetle was found in numbers invading the home. These infestations only occur when the insect is present in strawberry plantations in outbreak form.

Control.—We know of no satisfactory deterrent to keep them away. If specimens are observed in numbers, we would suggest gathering them by sweeping, and destroying them at once so as to reduce the infestation the following year. As the beetle is without wings and therefore cannot fly, it must walk into the house through some opening. Proper screening would

undoubtedly assist in preventing the admission of the insect.

OTHER SPECIES OF WEEVILS

A species closely allied to the strawberry root weevil is *Brachyrhinus ligneus* Goeze. This insect has been found only in Nova Scotia where it occasionally invades dwellings. It was first reported at Economy, N.S., in 1927, and at intervals since, but never with a record of injury. In 1936, a correspondent at Yarmouth, N.S., informed us that a number of the beetles were found and killed in his house each day from spring to autumn, but that they appeared to do no damage either in the garden or in the house. The European species, *B. rugoso-*

* Ann. Rep. Ent. Soc. of Ont. 1920, p. 30.

striatus Goeze, which has been recorded from various localities in Ontario, and also in Quebec, was reported invading a house at Oakville, Ont., on July 28, 1937. The correspondent stated, "They get into the house and on the walls, not so many in the daytime, but from about nine till ten or eleven o'clock at night they are plentiful." The European species, *Trachypphloeus bifoveolatus* Beck, taken in various localities in Nova Scotia and New Brunswick, was reported by A. D. Pickett to have invaded a house at Riverport, N.S., in June, 1936.

LADYBIRD BEETLES

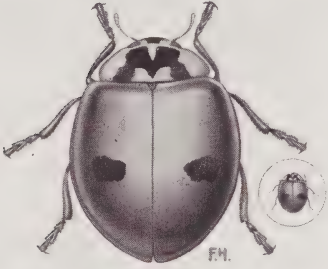


Fig. 82—The two-spotted ladybird, *Adalia bipunctata* L., enlarged and natural size (authors' illustration).

is of an orange-red colour marked with black and white.

Ladybird beetles, in both the larval and adult stages, feed voraciously on plant lice and other small insects. They are, therefore, decidedly beneficial and should not be destroyed.

THE STINK BEETLE, *Nomius pygmaeus* Dej.

During the summer months reports have been received, chiefly from the provinces of Ontario and British Columbia, of the presence of this insect in or adjacent to dwellings. In July, 1936, a specimen collected at Lake Annis, Yarmouth county, Nova Scotia, was received from A. D. Pickett, with a statement that the beetles were coming up through the cracks in one of the platforms of a cabin verandah in a camp for boys. The species has also been taken in Manitoba. The beetle, shown in figure 83, is brown or blackish in colour without markings. It is about one-quarter of an inch long.

Little is known of its life-history and habits, although occasionally it becomes a great nuisance. Fletcher*, writing of

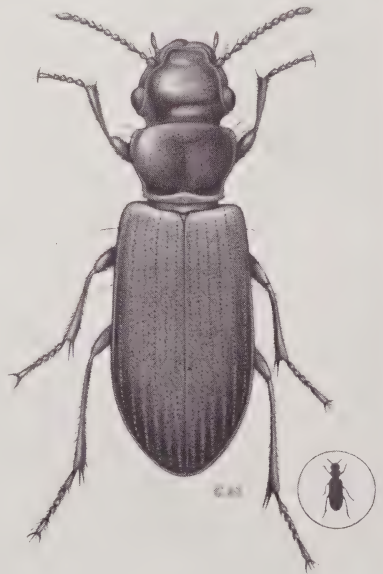


Fig. 83—The stink beetle, enlarged and natural size (authors' illustration).

* Recent additions to the list of Injurious Insects of Canada: Trans. Roy. Soc. Can. V., 230.

this insect in 1899, says: "Fortunately, in most places this is an extremely rare insect, but on two or three occasions it has appeared in small numbers about dwelling houses and has been an intolerable affliction to the inhabitants, who were actually driven away until the plague ceased." Regarding the odour he states that "the beetle, when crushed or excited, as by being caught in a spider's web, can and does give out a most far-reaching and repulsive fetor which is, besides, of a very lasting nature, articles which have been in contact with the beetles retaining the characteristic odour for several weeks."

THE BOXELDER BUG, *Leptocoris trivittatus* Say

In the fall of the year, during seasons when this bug is abundant, it is not unusual for the insects to migrate from their feeding grounds into out-buildings and houses in search of suitable quarters in which to pass the winter. They do not, of course, cause any injury in dwellings, but their presence is objectionable

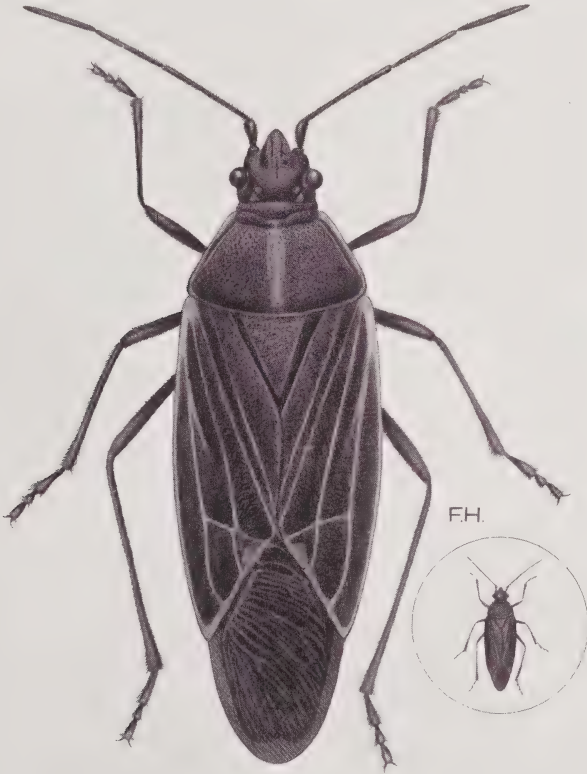


Fig. 84—The boxelder bug, enlarged and natural size (original).

to the occupants. The bug (fig. 84) is about one-half inch in length, moderately stout, blackish in colour with red markings. It feeds on the plant juices of the boxelder, sucked therefrom through its beak which is inserted into the plant tissues.

Control.—The boxelder bug, when very numerous, has the habit of gathering in numbers on the trunks of trees, large stones, posts, etc. At such times, they may be destroyed by pouring boiling water over them, or spraying them with a contact insecticide. A simple mixture is the following: coal oil, 1 quart; flour,

8 ounces; water, 2 gallons. Stir together the flour and coal oil, then add the water and churn briskly for five minutes. This spray should be used at once. Masses of the bugs on tree trunks near houses should be brushed off and then sprayed with the oil mixture. The oil should not be applied directly to the trees.

THE ROUGHENED DARKLING BEETLE, *Upis ceramoides* L.

In Western Canada, particularly in Manitoba, this fairly large, conspicuous beetle is often noticed in kitchens, particularly in boxes in which firewood is stored. The beetle, which is black in colour, about three-quarters of an inch in length, has wing cases which are noticeably roughened. It is closely related to the beetle of the yellow meal worm, *Tenebrio molitor* L., figure 24. The latter, however, is dark brown in colour with smooth wing cases. The roughened darkling beetle is widespread in occurrence in Canada. Outdoors, it occurs commonly under the bark of decayed or decaying trees. It has a rather objectionable odour.

THE MASKED HUNTER, *Reduvius personatus* L.

Occasionally complaints are received of specimens of the assassin bug, known as the masked hunter (fig. 85), being found in houses. This bug in its mature stage



Fig. 85—The masked hunter, nymph of *Reduvius personatus* L., enlarged and natural size (original).

is about three-quarters of an inch long, and in colour, black or dark brown. The younger stages or nymphs of the bug appear pale in colour owing to the fact that the body and other parts are covered with a sticky substance to which dust adheres.

In the United States the adult insect, some years ago, was given the popular name "kissing bug" from the fact that it was actually caught biting people. We cannot recall any records, in Canada, of this bug causing such injury, although undoubtedly it has the power to do so. It is supposed to frequent houses infested with bedbugs, upon which it preys, as well as upon other small soft-bodied insects.

Another species of assassin bug, *Fitchia spinosula* Stal., was reported biting humans in a house at Knappen, Alta., in 1931.

CAVE CRICKETS

These insects, also known as camel crickets, are found in cool, dampish situations, as, for instance, under logs, flat stones, etc. Not infrequently, however, they occur in the cellars of houses having earth floors. Some correspondents have claimed that the insects were observed in the kitchen, in late autumn, having come up from the cellar. They are curiously shaped insects, with their long legs and long feelers and no wings (fig. 86). Otherwise they are much like the true crickets. They are, usually, of a pale brown colour.



Fig. 86—A cave or camel cricket, enlarged and natural size (authors' illustration).

In Canada the species usually found in cellars belong to the genus *Ceuthophilus*, which have a body length of about half an inch. In the Prairie Provinces a larger species of the genus *Udeopsylla* is found in cellars. It is dark brown in colour, much larger than *Ceuthophilus*, with a body length of over one inch.

Control.—The remedy which has usually been suggested to destroy these insects is to cut up one or two carrots, and the same number of potatoes, and dust these lightly with Paris green. The poisoned pieces should be distributed in the places where the cave crickets are seen. Some of our correspondents, however, have reported little success from this remedy. The probability is that the insects would be attracted to the well-known grasshopper bait—bran, molasses and Paris green (see p. 52). A simple formula is: one quart of bran, one tablespoonful of molasses, one teaspoonful of Paris green (or white arsenic) and sufficient water to moisten the bran. The bran and the poison should be mixed thoroughly while dry, the molasses dissolved in the water, and the dry mixture moistened with the liquid, stirring well so as to dampen all the bran.

Poisoned baits such as the above should be used with great care and be placed where children or domestic animals would not have access to them.

FUNGUS AND SCAVENGER BEETLES

Small, pale reddish-brown, elongate beetles of the families Cryptophagidae (fungus beetles) and Lathridiidae (scavenger beetles), measuring from one twenty-fifth to one-tenth of an inch in length, are sometimes found in considerable numbers in dwellings, usually in cellars or basements, or at windows endeavouring to escape. One infestation of two species of scavenger beetles in a house in Dolbeau, Que., was apparently introduced in sawdust placed as an insulating material between the ceiling and the roof. The habits of these beetles vary considerably, and in nature they occur among dead leaves and on moss and leaves, under bark, at sap and on bruised fruit. For the most part they do no damage in dwellings, but a few species (Lathridiidae) have been recorded in the United States in drugs and other dry commercial products.

W. J. Brown, of our service, has identified the following species taken in dwellings in the localities as shown. Family Lathridiidae: *Enicmus minutus* L., Montreal and Dolbeau, Que.; Hamilton, Ont., and Newdale, Man.; *Cartodere filum* Aube, Ottawa, Ont., Winnipeg, Man., and an unrecorded locality in Saskatchewan; *Corticaria ferruginea* Marsh, Dolbeau, Que., and Toronto, Ont.; *Coninomus constrictus* Gyll., Montreal, Que., Ottawa, Ont. Family Cryptophagidae: *Cryptophagus* sp., Hamilton, Ont., and Newdale, Man. Mr. Brown has informed us that when the beetles are numerous in houses, two or more species usually occur together.

Control.—When infestations persist we recommend that materials attractive to the beetles be removed and the infested place be cleaned and aired, and sprayed with a fly spray such as the one described on page 11.

INSECTS AND OTHER ANIMAL LIFE IN DRINKING WATER

Wells that are poorly constructed or insufficiently protected from surface pollution may become infested with insects, especially aquatic diptera, and other forms of life. In this connection, specimens of the reddish midge larvae, known as "blood worms", are sometimes received from correspondents; also the so-called phantom larvae of the non-biting mosquito, *Eucorethra underwoodi* Underwood. In addition to insects, earthworms, slugs and snails, frogs, mice, and other creatures not infrequently gain access to wells and are drowned therein, and, in decomposing, pollute the water.

Control.—Wells subject to infestation by insects and other forms of life should be cleaned out and repaired or reconstructed to prevent such pollution. The upper portion of the well should be made watertight, and the top should be raised at least a foot above the ground and fitted with a watertight cover sloping away from the pump base. Wells with the upper six to ten feet lined with concrete are less likely to become infested and are easier to clean, than wells lined throughout with stone cribbing or brick. Infested drinking water should be boiled thoroughly before using it, in order to destroy any pathogenic organisms that may be present.

ANIMAL PESTS OTHER THAN INSECTS FOUND IN AND ABOUT DWELLINGS

It has been thought advisable to include in this bulletin a chapter on such common house pests as rats, mice, spiders, mites, etc., enquiries regarding the control of which are commonly referred to the entomologist.

TYROGLYPHID MITES, *Tyroglyphus* spp.

Species of mites of the family Tyroglyphidae frequently occur in foodstuffs of various kinds including flour and other cereal products, cheese, meats, dried fruits, etc. Under a magnifying glass these mites may be observed as pale, soft-bodied creatures, each having eight legs, except when very immature, when six legs are present.

Control.—When small quantities of foodstuffs are found infested they should be disposed of by burning. A method of ridding infested material of mites without destroying it, consists of heating it in an oven to a temperature of at least 140° F. When pantries or storerooms are infested they should be cleaned thoroughly with hot water and plenty of soap, and well sprayed with fly spray.

THE CLOVER MITE, *Bryobia praetiosa* Koch

This pest of clover and certain other plants occasionally invades dwellings to such an extent that large numbers of specimens may be found crawling on walls, furniture, pictures and other objects in the home. We have had reports of this happening in both autumn and spring. The clover mite is about twice as large as the common spider mite or so-called "red spider" which occurs on a great variety of plants, but otherwise its appearance is much the same.

Control.—If the mites occur in sufficient numbers to require action, we would suggest spraying the infested places with the fly spray described on page 11, using a small spray gun or atomizer.

ITCH MITES

Mites belong to the Class Arachnida, which also includes spiders and ticks. Certain species of mites of the genus *Sarcoptes* attack man and domestic animals. The principal species affecting man is the itch mite, *Sarcoptes scabiei* DeG., which is the cause of a contagious skin disease known as scabies or itch. The itch mite is a minute, whitish creature with four pairs of legs. It is more or less circular in outline and barely visible to the naked eye. The female mites burrow into the skin between the fingers, on the backs of the hands, about the wrists and on the sides of the body and legs, forming small tortuous tunnels in which they lay their eggs. The males remain on the surface of the skin hiding under dead epidermal cells. The affected parts itch intensely and become red and scabbed, or inflamed, as the result of scratching.

Control.—Take a hot bath and use plenty of soap on the affected parts. Follow this by a liberal application of sulphur ointment, rubbing it well into the skin. Repeat the treatment at intervals of a few days until the infestation has been eradicated. Sterilize towels, bedding, and clothing such as underwear, gloves, etc., by boiling or baking, to prevent reinfestation. Avoid contact with affected persons or their belongings.

BIRD MITES

Mites, (Dermanyssidae, fig. 87), are not uncommon on canaries and other cage birds, causing them great discomfort. The presence of these mites causes the birds to become mooney and they are seen to be constantly pecking their feathers. If present in numbers, the bird becomes sickly and death may follow. Their actual occurrence may be detected by placing a white cloth over the cage at night, and examining it early the next morning. If the mites are present, some of them will be seen on the cloth as little red specks, when full of blood, or of a greyish or brownish colour when not so engorged.

The northern fowl mite, *Liponyssus sylviarum* C. & F., and the common chicken mite, *Dermanyssus gallinae* L., sometimes invade dwellings during the summer months, and the latter may attack persons. The northern fowl mite is common on wild birds; and nests about houses are a source of infestation, particularly when the



Fig. 87—Mite from canary, greatly enlarged (original).

fledglings depart. In the latter part of June, 1934, great numbers of these mites invaded a small church in the Ottawa district, Ont., and prevented the holding of divine service.

Control.—For mites on cage birds: as soon as it is known that there are mites in the cage, the bird should be removed and the cage thoroughly scalded out in every part—the wires, perches and the bottom. Before putting the bird back again, take a small paper bag, such as is used for groceries, and having put into it about a teaspoonful of fresh pyrethrum insect powder, drop the bird into the bag and hold the top closely shut for about half a minute. The little creature will be frightened at this unusual treatment and having no foothold will flutter a great deal. This is just what is wanted, for it will disturb the powder and make it permeate the whole plumage. Although harmless to the bird, the powder is fatal to the mites and causes them to drop from the feathers. After removing the bird, the bag and its contents should be destroyed by burning.

Infestations of the northern fowl mite and the common chicken mite may be prevented by removing the source of the mites. Hen houses adjacent to dwellings should be periodically treated for mites. Birds' nests, particularly those of starlings and sparrows should be removed from buildings and destroyed. The liberal use of pyrethrum-kerosene spray is recommended to eliminate infestations that have developed.

TICKS

Ticks (fig. 88) are principally of importance as pests of live stock, but sometimes attack man and domestic animals, particularly dogs, and thus on occasion may be brought into the home. They are small, leathery-skinned, eight-legged animals, bean-shaped when replete with blood, and often measure as much as half

an inch in length. They are parasites, and feed on the blood of animals and man. When attached they are difficult to dislodge owing to the presence of barbs on their mouth parts. Ticks sometimes cause "tick paralysis" in humans and animals, which may end fatally if the ticks are not removed. When they are removed, however, the symptoms usually abate rapidly, resulting in recovery. There are at least four species of ticks in Canada that sometimes attack man. These include the dog tick, *Dermacentor variabilis* Say, the wood or paralysis tick, *D. andersoni* Stiles, and the castor bean tick, *Ixodes ricinus* L. The species *Ixodes cookei* Packard, which has been recorded from a variety of hosts in the United States, has been taken on dogs and man in the Ottawa district. The paralysis tick is the carrier of Rocky Mountain spotted fever in Western North America, and may also transmit a disease known as tularaemia.



Fig. 88—The paralysis tick, engorged female, about 5 times natural size (original).

Control.—Great care should be exercised in removing ticks for if the head is left embedded in the skin troublesome sores are liable to result. The application of raw linseed oil, to which has been added a little pine tar, is said to cause the ticks to loosen their hold. Vaseline, petroleum and essential oils have also been recommended. The tick also may be removed by pulling it gently and snipping off the piece of skin in which the head is embedded. Touching the body of the tick with a hot needle has been found effective in causing the tick to release its

hold. The wound should then be treated with iodine or some other antiseptic. To relieve pain, bathe the wound in hot water followed by a strong solution of sodium bicarbonate (baking soda), allowing it to dry on the affected area.

SPIDERS

There are a great many different kinds of spiders in Canada. They are commonly found in houses, particularly in summer homes, spinning their webs in places little disturbed. Verandahs are particularly chosen for this purpose.

Most housewives, in fact most humans, dislike spiders even to a marked degree. As a matter of fact they are interesting creatures, with rare exceptions, in no way harmful. Even when handled, spiders which occur in Canada usually do not bite. In any event, the bites of most species are not to be compared with that of the mosquito. Their food consists of flies and other soft-bodied insects. Species frequently sent in by correspondents belong to the genus *Aranea*. Three



Fig. 89—Female black widow spider, dorsal and ventral views; much enlarged (original).

species found commonly about houses and outbuildings are known as the three house *Araneas*. One species, however, has been found recently in various parts of Canada, notably in the West, which is to be feared on account of the definitely poisonous character of its bite. This is the black widow spider, *Latrodectes mactans* Fab. It is a small black spider with red or yellow markings. The most constant of these markings is one shaped like an hour-glass on the underside of the abdomen (fig. 89). The venom of the black widow spider is rapid in its action, and pain may be felt within a few seconds after the bite. This pain may gradually spread over the body, and the larger muscles may become sore and rigid, with occasional spasms. The pain reaches its maximum in 1-3 hours, continues from 12-48 hours, and then gradually subsides. A person who is

bitten should be put to bed, kept as quiet as possible, and be given plenty of water to drink. The site of the bite should be painted with a local antiseptic such as iodine, to prevent secondary infection. A doctor should be called immediately.



Fig. 90—A pseudoscorpion, enlarged and natural size (authors' illustration).

ally, all that is necessary is to sweep away the webs, and, if possible, allow the spiders to depart unhurt. If, however, more drastic action is desired, spraying the infested places with the fly spray mentioned on page 11, would probably be of value.

PSEUDOSCORPIONS

These small active creatures (fig. 90), known also as false scorpions from their resemblance to the true scorpions, are occasionally found in houses in small numbers. As the figure shows, they are curiously-shaped arachnids, and are closely related to the spiders. In size they are rather less than one-eighth of an inch in length and, in colour, brownish. They do no harm in houses, in fact they are beneficial in habit as they feed on small insects such as book lice, discussed on page 54. Under natural conditions they are found under stones, beneath the bark of trees, in moss, etc. In houses they are occasionally found between the leaves of books, etc.

THE HOUSE CENTIPEDE, *Scutigera forceps* Raf.

This centipede, as yet, is not widespread in Canada, and our records indicate only occasional infestations. It is a curious fragile-looking creature (fig. 91) with long, slender legs, the posterior pair of which are twice as long as the others. The antennae, too, are very long and threadlike in appearance. In colour the house centipede is of a greenish-yellow shade; specimens which we have received, collected in Ontario, measured over two inches long with the legs spread.

The bite of this centipede is supposed to be poisonous; otherwise the creature may be regarded as beneficial as it is known to destroy house flies, cockroaches and other insects. Further records of this centipede would be welcomed.

Closely related to the true spiders are the species known as harvestmen or daddy-long-legs, which frequently are found in houses. They also feed on small insects, and are quite harmless to human beings.

Control.—Owing to their generally beneficial habits, we do not recommend their wholesale destruction. In houses and around verandahs they are, of course, not only objectionable, but the webs they spin are very unsightly. Us-

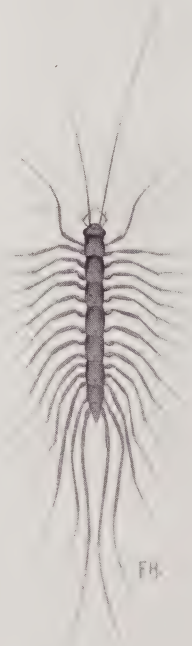


Fig. 91—The house centipede, natural size (authors' illustration).

SOW BUGS

Sow bugs (fig. 92), or wood lice, so-called, are frequently found in houses, particularly in cellars. They prefer dark situations where decay is taking place. When full-grown, they are about half an inch in length, dark gray in colour, and of an oval, flattened shape. They are scavengers, feeding during the night on almost all kinds of dead or decaying matter.

Control.—In combating these crustaceans, it is important to deprive them as much as possible of hiding places. Old boxes should be broken up and burned, in fact debris of any kind should not be allowed to accumulate. Usually these pests disappear of their own accord, as soon as the house is dried out by the heating system, following the advent of cold weather. However, as a remedy, the following mixture is recommended: Paris green, 1 part by weight; icing sugar, 10 parts by weight.

The mixture should be placed where the sow bugs congregate, and when it becomes encrusted a fresh supply should be used. It should, of course, not be placed on vegetables, or where children or house pets might reach it.



Fig. 92—Sow bugs feeding on manure (after Gibson and Ross).

MILLIPEDES

These creatures (fig. 93), known also as thousand-legged worms, are, some years, found in noticeable numbers in the cellars of dwellings, particularly those having earthen floors. Under such conditions they probably do not cause any damage, but their presence is objectionable. In general they may be described as rather slender, hard-bodied, cylindrical worm-like creatures with numerous pairs of legs. Their natural food is decaying vegetable matter.



Fig. 93—A common millipede (after Gibson and Ross).

Control.—The placing, as traps, of slices of potato, which have been dipped in a Paris green solution, or dusted with dry Paris green, near the infestation is recommended, providing that precautions are taken to prevent accidental poisoning. Lumps of dough, sweetened with molasses, may also be used as traps, collecting them at frequent intervals and destroying the millipedes attracted thereto.

THE BROWN OR HOUSE RAT, *Rattus norvegicus* (Erxleben)

The most formidable and the most widely distributed of the species of rodents which are destroyers of food is the common brown or house rat (fig. 94). It invades houses, stores, warehouses, and markets; and besides destroying fabrics and leather goods, it attacks all kinds of food—grains, meats, groceries, fruits, vegetables, etc. In town and country it attacks poultry, destroying eggs and chickens. The foundations of buildings, also, are damaged by its activities. Everywhere it destroys unceasingly, and yet its presence is tolerated.

Besides the enormous destruction of food supplies, the brown rat is a serious menace to public health. It is a carrier of bubonic plague, one of the most devastating of human diseases, which has been carried by the rat all over the world. In the fourteenth century it is estimated that about twenty-five million people died in Europe from the "Black Death", as this disease was called, and 2,000,000 deaths are stated to have occurred during the epidemic of the plague in India in 1907. Bubonic plague is transmitted from rats to human beings by fleas, and modern methods of preventing the spread of plague involve the most vigorous eradication of rats, and the prevention of their landing in seaports from ocean-going vessels.



Fig. 94—The brown or house rat (authors' illustration).

Control.—Rats should be denied access to places where they obtain food and rear their young. To accomplish this, buildings should be made rat-proof; and the best material of construction for this purpose is concrete. In the construction and maintenance of buildings in which food is kept and rats are likely to find lodgment, special attention should be paid to the closing of all apertures, especially in foundations where drain and other pipes enter. Doors to such buildings should be bound with strong sheet metal. Constant vigilance should be exercised with a view to checking any inroads of these pests; the holes of rats or mice can be stopped readily by a little concrete, broken glass or crockery. Cement should be used for foundations of all kinds of storehouses, granaries, poultry houses, etc. Corn cribs can be rendered rat-proof by inclosing them in heavy galvanized wire netting of half-inch mesh. Storerooms should always be made rat-proof by the adoption of the foregoing constructional methods.

Civic authorities, and particularly the health authorities, should adopt and enforce sanitary conditions in towns and cities. Cleanliness and the prevention of the accumulation of refuse and garbage are essential in the eradication of rats. The maintenance of garbage dumps is one of the greatest contributing causes to the abundance of rats. From all points of view the immediate incineration of garbage is the only proper treatment and method of preventing the increase of rats and the breeding of flies, both important agents in the spread of infectious diseases.

One of the most effective methods of destroying these pests is trapping. The best traps are those of the spring or guillotine type. Such traps may be baited with any of the foods preferred by these animals, such as meat, fish, oatmeal, cooked eggs, or fruit. It is necessary to use a large number of traps, the more the better. The wire cage traps also are excellent when rats are abundant.

Where there is no danger of food becoming contaminated, or of other animals eating the bait, poisoning is a speedy method of destruction. The greatest care, however, must be exercised in the use of poison. In destroying rats and mice in houses it is inadvisable to use poison, not only on account of its danger, but because the occurrence of the inaccessible corpses of these animals is likely to prove objectionable. Barium carbonate is a cheap, tasteless, and odourless poison. It may be mixed in a dough composed of four parts of meal or flour and one part of the poison, or a stiff dough of eight parts of oatmeal and one of poison.* Water should be added, when necessary, to make the bait moist. The poisoned dough should be placed in the runways of the animals. Strychnine is a well-known and rapid poison, usually used in the form of strychnia sulphate. The dry crystals of this chemical are inserted in baits, such as meat or cheese. With oatmeal, or grain such as wheat or corn, it is used in the form of a syrup which is made by dissolving half an ounce of strychnia sulphate in a pint of boiling water; a pint of thick sugar syrup is added, and the whole mixture is stirred thoroughly. Oatmeal should be moistened with the syrup, and grain should be soaked overnight. Arsenic is used in most rat poisons. It may be fed in the form of powdered white arsenic, used as described above. A good bait is prepared by thoroughly mixing one pound of oatmeal, one pound of coarse brown sugar, and a spoonful of arsenic. This is placed in the runs of the animals. Phosphorus is a common ingredient of rat and other animal poisons, but owing to the danger involved in mixing it and in the subsequent use of the home-made or commercial preparations on account of its inflammability, its use as a rodent poison is not recommended.

During recent years powdered red squill has been used with success in rat extermination campaigns. Red squill has the advantage over other commonly used raticides in that it is relatively harmless to humans and domestic animals, but, when properly applied is highly toxic to rats. The following instructions have been summarized from U.S.D.A. Leaflet No. 65, issued in January, 1931. Chopped fresh fish, canned fish, freshly ground meat, and cereal, such as oatmeal, corn meal or bran, are recommended as baits. In preparing the fish or meat baits, mix one ounce of powdered red squill with enough water to make a thin paste without lumps, and add this to one pound of the fish or meat and mix thoroughly. In making a cereal bait, mix one ounce of dry red squill with one pound of cereal and then add one pint of sweet milk or water, stirring thoroughly.

It is recommended that fish, meat and cereal baits be used at one and the same time, to ensure that all the rats are attracted and eat of the poisoned material. Before distributing the baits an attempt should be made, in so far as possible, to remove or cover other sources of food available to the rats. The bait should be put out in late afternoon, in small portions about the size of a

* The methods of preparing these poisoned baits are those recommended by the Biological Survey of the United States Department of Agriculture.

marble, in and about places frequented by the rats. After the lapse of three days uneaten baits should be collected and destroyed. If, after an interval of three weeks, surviving rats are still noted, distribute baits identical with those described above, without the addition of red squill, at two-day intervals, to renew the confidence of the rats. When it is seen that these latter are being eaten readily, all uneaten portions should be removed and fresh baits substituted containing red squill. This procedure should result in a satisfactory clean-up of the rodents.

Dusting the floors of infested premises such as warehouses with sodium fluosilicate (silicofluoride) once a month has also been reported to be efficacious in controlling rats. In the use of this poison in warehouses, G. E. Sanders, formerly of our service, adopted runways made of eight-inch boards tilted against the walls in which to place the material. Rats like such places in which to run and hide. The sodium fluosilicate adheres to their feet and is licked off. In this way the rats become poisoned.

THE COMMON HOUSE MOUSE, *Mus musculus* L. *

This common household pest (fig. 95) needs no description nor is it necessary to take space to discuss its habits. Householders are only too familiar with the damage it causes and the kinds of food to which it is specially attracted. Like the brown rat, it came to North America from abroad.



Fig. 95—The common house mouse (authors' illustration).

Control.—The well-known guillotine type of trap (fig. 96) is very useful in ridding dwellings of mice. Such traps may be baited with cheese, fried bacon, raw meat, oatmeal or fruit. A combination bait very often used is a mixture of peanut butter, rolled oats and chopped raisins. A drop or two of aniseed oil

* The authors are indebted to Dr. R. M. Anderson, Chief of the Division of Biology, National Museum of Canada, for assistance in preparing the discussion regarding various species of mice.

may be added. This bait has been found to be very attractive to all rodents. If the animals are abundant, a number of traps should be used and arranged in places which the mice are known to frequent.

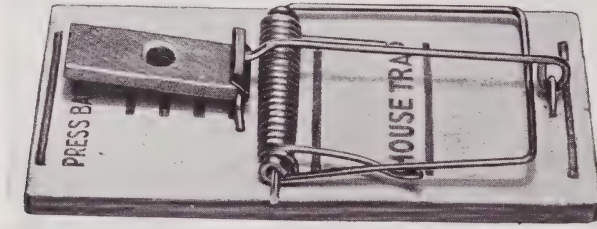


Fig. 96—The common guillotine type of mouse trap (authors' illustration).

DEER MICE

There are several species of deer mice which may enter dwellings and feed upon foodstuffs attractive to the common house mouse. A common species of this group, and one which has been specially complained of, is the white-footed mouse, *Peromyscus maniculatus* (Wagner). Dr. R. M. Anderson reports that he has found that, in the Ottawa region, this species seldom enters occupied cottages in the summer, but may make an entrance in the autumn. It is widespread in distribution, occurring from Nova Scotia to British Columbia. The deer mouse, *P. leucopus* (Rafinesque), is common in southern Ontario.

Control.—The simple wire trap of the guillotine type, illustrated above, may be employed to catch deer mice. Dr. Anderson found that setting about one dozen baited guillotine traps around the corners of rooms and on shelves before closing up summer homes would account for almost every mouse that entered, and the bodies would be desiccated by spring.

FIELD MICE

The field mice, also known as voles, are familiar to farmers from their injuries to grain, roots, etc., and to fruit growers from the damage they cause to apple and other trees. Lantz* describes these animals as having "stout bodies, blunt, rounded muzzles, small eyes and short ears—often completely concealed by the fur. The tail is short and hairy; the soles of the feet are naked or clothed with short hairs, and have five or six foot pads (plantar tubercles). The incisors are broad and not grooved."

The meadow mouse, *Microtus pennsylvanicus* (Ord.), is a common species of field mouse, occurring in all the provinces of Canada, and may periodically become very abundant.

Control.—For the destruction of field mice, causing injury to grain, etc., in out-houses and barns, the traps used for the common house mouse are of value. Regarding their control in districts where they cause damage to fruit trees, the reader is referred to Dominion Experimental Farms Exhibition Circular No. 17, and Bulletin No. 55, new series, Dominion of Canada Department of Agriculture.

THE RED-BACKED MOUSE, *Clethrionomys gapperi* (Vigors)

This mouse, also, is widely distributed in Canada. It is a smaller species than the meadow mouse, *Microtus pennsylvanicus* (Ord.), with larger and more conspicuous ears. The hairs on its back are of a rust-red colour, from which characteristic it derives its common name. It, too, enters houses, readily attacking foods of various kinds. Mr. C. H. Young, of Ottawa, when living at Hurdman's Bridge, Ont., not infrequently caught specimens in his home.

Control.—Same as for the common house mouse (see p. 88).

* Bull. 31, Biological Survey, U.S. Dept. of Agriculture.

SHREWS

Some years small mammals known as shrews are occasionally found in houses, particularly farm dwellings. While their presence may be objectionable to the occupants, as a matter of fact, their entrance is probably largely accidental. Their natural food is animal matter, particularly insects, so it may be assumed that they are useful creatures and not in any way destructive to anything in the house. The long-tailed or masked shrew, *Sorex cinereus* Bach., and the short-tailed shrew, *Blarina brevicauda* (Say), are two common species.

Those who live on farms should know the appearance of the shrews and be able to distinguish them from the destructive field mice. Brooks,* writing of the shrews, says that they may very easily be distinguished from the mice by their pointed nose, small eyes and finer fur. The body of the long-tailed shrew is much smaller than that of the common house mouse. The short-tailed shrew has a stouter body than the house mouse and a much shorter tail. Its fur, too, is decidedly glossy. Owing to their habit of feeding on insects these useful little animals should be protected.

SQUIRRELS

Country homes, closed during autumn, winter and spring months, are not infrequently entered by squirrels (fig. 97), and such articles as mattresses, pillows and cushions are damaged to an important extent. Houses adjacent to



Fig. 97—The common red squirrel (authors' illustration).

park areas are also entered at times. In this connection, complaints have been received of injury to window woodwork, apparently from attempts made by the animals to regain their freedom. The common red squirrel, *Tamiasciurus hudsonicus* (Erxleben), is the species mostly responsible for injury in houses.

*Bull. 113, West Virginia Univ. Exp. Sta.

Control.—Before vacating summer homes in districts where squirrels are abundant, it would be a wise procedure to cover the tops of chimneys and other openings through which the animals may gain entrance.

BATS

Bats (fig. 98) often establish colonies in the attics and walls of dwellings, especially in rural sections, but also in urban communities, and become a nuisance to the occupants owing to the objectionable odour that may arise from their excretions, and the noises they make in their roosts during the night. Moreover,



Fig. 98—Long-eared brown bat, natural size (original).

they are the hosts of a species of bug described on page 23. Apart from these characteristics, it should be remembered that bats are harmless and useful creatures that feed exclusively on night-flying insects, many of which are destructive pests. For this reason it is desirable not to destroy the bats, but to exclude them from human habitations by other means as indicated on page 92.

Control.—Bats may be evicted by means of a repellent substance. The United States Bureau of Biological Survey recently reported that an effective repellent is 2 to 5 lbs. of naphthalene flakes scattered in the spaces occupied by the bats. This is said to cause them to leave the roost even in broad daylight and prevent their return so long as the naphthalene odour persists. After the bats have departed, all openings through which they may gain entrance, such as small crevices around the eaves and at the bases of rafters, should be closed by means of strips of wood, or metal, or with plugs of oakum, rags or similar materials. Cracks around the base of the chimney may be filled with cement.

WEASELS

These creatures (fig. 99), which are of common occurrence in Canada, occasionally enter dwellings and outhouses. As a class they are very useful mammals, owing to the fact that they are destroyers of destructive species of rodents, such, for instance, as gophers and rabbits. They are, therefore, undoubtedly a valuable aid in the control of such agricultural pests. The late Norman Criddle, a well-known naturalist, of Treesbank, Man., who had given



Fig. 99—A common weasel with captured mouse (authors' illustration).

these animals considerable study, informed us that weasels are usually attracted to houses in search of mice, but when such happens, they may attack meat, if left in an exposed place. In the Prairie Provinces, the species which are known to enter houses are the long-tailed weasel, *Mustela frenata longicauda* Bonaparte, and Bonaparte's weasel, *Mustela cicognanii* Bonaparte. According to Dr. R. M. Anderson, the latter species ranges from Nova Scotia to British Columbia. A third species, the New York weasel, *M. frenata noveboracensis* (Emmons), occurs in Ontario, north to Ottawa.

THE HOUSE SPARROW, *Passer domesticus* L.

The common house sparrow (fig. 100) is widely distributed and abundant in settled parts of Canada and often becomes a nuisance about dwellings. It befouls buildings, and other places it frequents, with excrement, and destroys or drives away more desirable species of wild birds from the vicinity of human habitations, where their presence is most welcome. It feeds on a wide variety of foods, devouring grain in fields, poultry yards, etc., and causing injury to fruits and young growing vegetables. It is true that the house sparrow also feeds on weed seeds and noxious insects, but its bad qualities outweigh the good.

Control.—Methods of controlling house sparrows include the destruction of eggs and nests, trapping, shooting, and poisoning. The latter two measures probably could be safely applied only under rural conditions. Poisoning is a method that should be used with caution to prevent possible injury to humans, poultry and other useful birds, or other animals. According to Kalmbach,* strychnine-coated wheat bait is quick and certain in its action. This may be prepared “by mixing one-eighth of an ounce of pulverized strychnine alkaloid with $1\frac{1}{2}$ teaspoons of starch or wheat flour and moistening with sufficient cold water to make a paste of the consistency of thick cream; three-fourths of a gill of boiling water should then be added and the mixture stirred well to make a clear, smooth paste. It may be necessary to heat this somewhat to get the proper results. The paste should then be poured over a quart of small-kernelled wheat reasonably free of dirt, and the whole stirred until the poisoned paste is

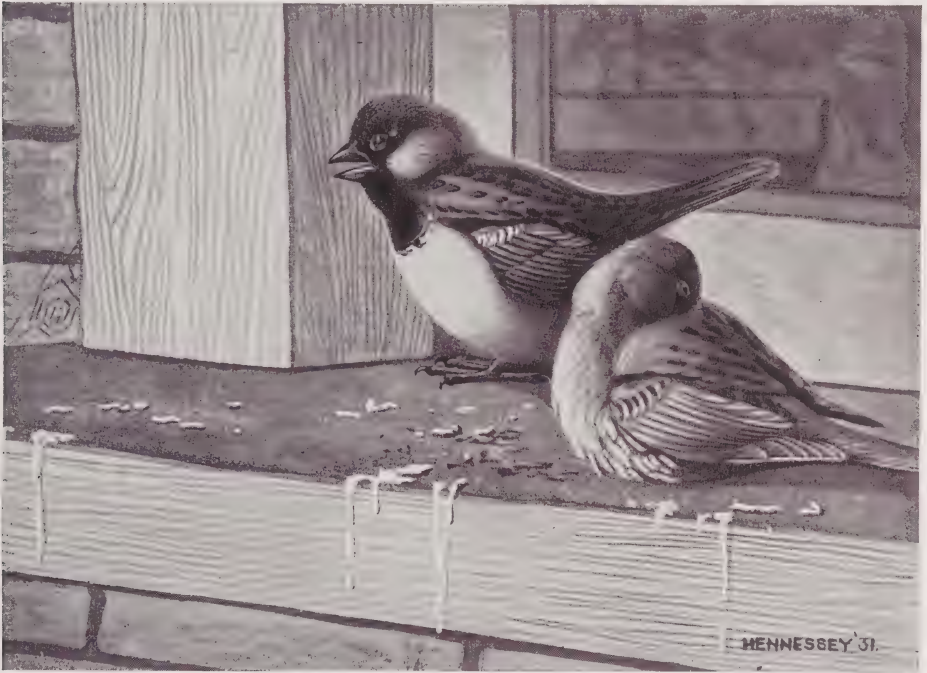


Fig. 100—House sparrows, male and female, on window sill (authors' illustration).

thoroughly distributed. The bait can be mixed by shaking it in a 2-quart fruit jar. It should then be spread out thinly and allowed to dry thoroughly if it is to be stored. The utensils used may be cleaned with a hot soap solution, after which they should be well rinsed.”

The poisoned grain may be scattered about the feeding grounds of the sparrows in such places as “unused poultry runs, roofs of poultry houses, and backyards not frequented by domestic pigeons and poultry.” It is reported to be particularly effective in winter time.

THE BARN SWALLOW, *Hirundo erythrogastra* Bod., and

THE CLIFF SWALLOW, *Petrochelidon lunifrons* Say

These well-known birds (fig. 101), which have a wide distribution in Canada, build their nests, the former usually under shelters of barns and out-buildings, and the latter in cliffs. Not infrequently, however, the nests are erected on

* U.S. D.A. Leaflet No. 61, 1930.

the sides of dwellings. Occasionally complaints are received in this regard, particularly from people who do not realize the beneficial habits of these birds, and also for the reason that at times the swallow bug, which frequents the nests of the birds, finds access to the house. The food of swallows consists almost

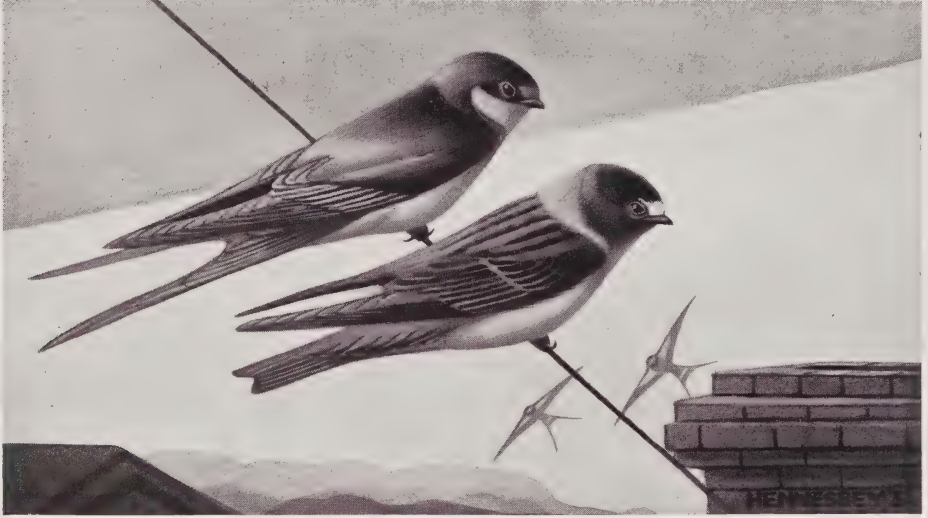


Fig. 101—Swallows: the barn swallow above, and the cliff swallow below (authors' illustration).

entirely of insects, such as mosquitoes and other small species, and for this reason it is considered unwise to interfere with the nest-building habits of the birds. It is preferable to encourage these useful birds about farm and country homes.

ANTIDOTES FOR POISONS*

Several compounds poisonous to humans are included among the materials recommended in this publication for controlling insects and certain other household pests. These poisons are listed below, together with the antidotes for use in cases of emergency. Emetics referred to may consist of a large teaspoonful of ground mustard and, or, a like quantity of common table salt, in a tumblerful of warm water, repeated as necessary. *In all cases of poisoning send for a doctor immediately.*

Acids.—Hydrochloric acid, sulphuric acid (for carbolic acid, see under Phenols). Give no emetic. Have the patient drink freely of concentrated lime water, calcined magnesia in milk or water, chalk in water, milk of magnesia, baking soda, washing soda, or soap suds, followed by raw eggs, milk, or sweet oil.

Arsenic.—Sodium arsenate, sodium arsenite, Paris green, etc.—Give a prompt emetic, or use syphon tube cautiously inserted. Administer large draughts of warm milk and water, raw eggs, hot water with olive oil, melted butter, limewater, or magnesia in water; also tablespoonful doses of hydrated ferric oxide, if available. Apply warmth.

Barium.—Barium carbonate.—Give an emetic, followed by Epsom salts, Glauber's salts, or any alkaline sulphate.

Cyanides.—Sodium cyanide and other cyanide compounds.—If possible, cause immediate vomit; use syphon tube with permanganate solution 60 grains to two gallons of water, or emetics. Put cold applications to the head and neck; dash cold water on the face; place hot water bottles at the feet and sides of the body. Apply smelling salts (ammonium carbonate). Give aromatic spirits of ammonia, brandy or whisky, one teaspoonful in a little water every 5 to 15 minutes by mouth (double quantity by rectum). Prevent sleep; apply artificial respiration. (See also under hydrocyanic acid gas.)

Fluorides.—Sodium fluoride, sodium fluosilicate (silicofluoride).—Give an emetic to cause the patient to vomit, followed by limewater, milk of magnesia, or a 1 per cent solution of calcium chloride. If these are not available, hydrated lime in water, or even ground wall plaster may be given.

Hydrocyanic Acid Gas.—Give neither alcohol nor emetics. Remove patient into the fresh air, loosen clothing, but protect from chill by wrapping in warm blankets. Apply artificial respiration if the breathing has stopped. (See also under cyanides.)

Paris Green.—(See under *Arsenic*).

Phenols.—Cresol, carbolic acid, etc.—Give an emetic or use syphon tube cautiously, washing out the stomach with Epsom salts solution. Then give milk, white of eggs, olive oil, brandy or whisky. Keep the patient warm.

Strychnine.—All compounds.—Give an emetic or otherwise cause to vomit; use syphon tube. Keep the patient quiet; give strong tea, and charcoal mixed with water, freely; give also one of the following: potassium bromide 20 grains; luminal 2 grains; barbitone 10 grains; chloral hydrate 20 grains; elixir of triple bromide 2 teaspoonfuls. If breathing is failing, perform artificial respiration between convulsions; this is very important.

Tobacco Extracts.—Nicotine sulphate, etc.—Give an emetic, or evacuate the stomach with syphon tube, using plenty of water. Put the patient to bed, and give strong coffee or tea, and charcoal mixed with water, freely. Apply warmth to the feet and sides of the body. Use artificial respiration if necessary.

* This section was prepared with the co-operation of the Department of Pensions and National Health.

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